IMPACT INVESTMENT FOR FOOD SECURITY AND NUTRITON:

ATTRACTING FINANCE INTO HIGH NUTRIENT HORTICULTURAL VALUE CHAINS AS A CATALYST FOR A MORE EQUITABLE AND HEALTHY FOOD SYSTEM

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ABSTRACT

This research contributes to global efforts to attract additional impact investment finance into horticultural value chains as a catalyst for scaled up dietary diversity and, ultimately, better nutritional outcomes with emphasis on rural and urban poor populations in developing countries. A review of demographic, consumption, technological and economic trends suggest that drivers of food system change can also underpin business opportunities for agri-food SMEs. Investment into early and mid-chain private enterprises enables them to deploy technology for increased supply of nutritious food, reach new markets, and reduce loss in fruit and vegetable supply chains.

A landscape assessment highlights the gap between demand for finance from domestic focused fruit and vegetable value chain enterprises, and supply of capital. It examines the role of impact investment – dual social and financial return-seeking funding - in delivery of common financial products and value chain finance structures in the agri-finance ecosystem. Hypothesied constraints on investments into domestic oriented horticultural supply chains are tested through interviews with agri-food impact investors. We investigate investor's expectations on risk, return, cash flows, preferred crops and social impact priorities from their investment portfolios. Case studies in the Indonesian Javanese fruit and vegetable markets examine demand for finance from horticultural supply chain actors (SME agribusinesses), illustrating financial services and product design priorities. The scope of the primary research sheds light on market opportunities and the supply chain characteristics that make such investments attractive to agri-food impact investors. We find that presentation of a business case alongside the nutrition and food security impact case can attract more investment capital and tailored financial products for horticultural supply chain enterprises.

BIOGRAPHICAL SKETCH

Rebecca Parkinson is an impact investment professional with over twelve years' experience persuing financial and social outcomes through impact investing in the service of poor and disadvantaged families across Asia.

Rebecca was motivated to pursue her Cornell University Masters of Professional Studies in International Agriculture and Rural Development because of a desire to contribute to a more sustainable and equitable food system, influenced by her work with rural populations, concern for the world's most pressing environmental, economic and poverty challenges and personal involvement as a member of mixed family farming enterprise in Australia.

Prior to her time at Cornell, Rebecca was Investment Services Director at Opportunity International Australia where, together with an international team, she evaluated the financial, operational and social performance of a portfolio of mission oriented microfinance institutions in four countries serving over three million families with credit, savings, insurance and remittance services.

Rebecca started her career in the private sector where she became a Certified Practicing Accountant, and holds a Masters in Development Studies from the University of New South Wales, and a Bachelor of Arts and a Bachelor of Commerce from the Australian National University.

DEDICATION

To all the hardworking, knowledgeable and determined farmers of this world who steward our natural environment and grow the food that keeps the rest of us alive, healthy and happy.

Thank you.

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I thank my family, especially my parents, and the many friends who encouraged me to undertake this adventure – a countercultural break in my working life to be immersed in learning, amongst the learned, and once again be reminded that with the little I know, together we can make a difference. I am so grateful for new friends made at Cornell University and New Life Presbyterian Church Ithaca, you occupy a special place in my heart and are often on my mind. Special thanks to my insightful, gracious and cheerful advisor Prof. Miguel Gomez who never failed in his encouragement.

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A. Introduction

In April 2016, the United Nations General Assembly proclaimed a UN Decade of Action on Nutrition from 2016 to 2025 (HLPE, 2017). Increasingly, the 'triple burden of malnutrition' is being observed in developing countries, with both over and under consumption of calories present alongside micronutrient malnutrition, sometimes present in a single household. Globalisation is exacerbating obesity and over-nutrition concerns, with the prevalence of cheaper convenience foods, especially attractive to the time-starved women in both urban and rural areas (Reardon, Boughton, et al., 2015). These challenges are exacerbated in poorer rural and smallholder farmer (SH) populations. This is demonstrated in Indonesia, where 93% of farmers, small family farms spread over 17,000 islands, are 2/3rds more likely to be living below the poverty line than the national average (FAO, 2018). There is an enormous need to influence food systems towards provision of healthier, more nutritious food for the poorest through fresh fruit and vegetable (FFV) supply chain investments.

Domestic oriented FFV supply chains offer great potential to address these challenges for two reasons. Firstly, in the developing countries of Asia domestic food production constitutes 90-95% of the food economy, with international trade making up only 5-10% of the trade in food (Reardon, 2015). Secondly, producers of food – farmers - make up the bulk of rural economies and the bulk of the poor (Hazell, Poulton, Wiggins, & Dorward, 2007). Promoting strong food value chains offer rural populations opportunities to benefit as producers and employees, and for benefits to be shared as domestic economies grow. Improving food security is an additional opportunity that can be achieved by improving affordability and access to a more diverse diet (supply side) for domestic consumers. In addition, there is a rising awareness of the volume and value of food lost and wasted along the supply chain between harvest and consumption. Nutrition oriented research and strategies to address this loss by capturing private sector business and dietary value, in particular from fresh produce, are lagging.

This paper takes a systemic perspective on the private sector's role in improving the aggregate nutritional value of the food system emphasizing the potential contribution of impact finance investors. It extends a 'private sector' definition to include all profit seeking enterprises with a role in influencing supply of nutritious food, from producers and small-scale traders to mid-chain SMEs and large national and international corporates. In the nutrition agenda, the opportunity to increase the quality, quantity and diversity of healthy foods on the supply side of food systems remains

eclipsed by a focus on household consumption choices and fortification of seeds and low processed staples. Ultimately it is those supply chain actors beyond farmer producers – the small-medium scale 'mid-chain' businesses operating further down fresh fruit and vegetable supply chains - who offer enormous potential to impact the nutritional composition of food supply systems.

Like any business, mid-chain SME agri-food enterprises require capital to grow, improve efficiency, develop new products and reach new markets. An examination of small scale producer and agri-business supply of finance reveals that only a small proportion of the financing needs of smallholder farmer production and traditional and cash crop commodity value chains are being met by current financial systems and existing providers. Today, estimates of demand for agricultural finance from the world's smallholder farmers is around USD $200 billion, of which supply totals only $50billion (ISF, 2016). This estimate primarily covers internationally traded export crops, and excludes capital demands from agri-businesses providing essential inputs and mid-chain SMEs transforming crops to marketable and digestible products. Investment into strengthening FFV value chains (VCs) are crucial in addressing malnutrition at scale. The majority of financing is directed towards staple cereal crops as they present more organised farmer groups, tighter value chains and hence lower risk to capital providers. However in order to meet the need for dietary diversity and range of micronutrients, additional crops need to be available and accessible to poorer populations. The capital needs of FFV SME agribusinesses – horticultural producers & intermediate supply chain actors further down the supply chain - present a huge unmet need to both local and international lenders.

The objective of this study to examine the business case for investing in small and growing domestic FFV chain actors. This is the missing link to attracting greater financial resources from capital providers and grow and improve the efficiency and reach of these food suppliers. Food security approaches must look beyond a target beneficiary group's needs (nutrition only focus) or beyond a specific commodity's value chain gaps (smallholder agri-finance only focus) to systemic opportunities and drivers in the food system and what they mean for making a business case for an FFV agri-food enterprise investing in its operations.

a) Methodology and Data Sources

The methodology includes both primary and secondary data collection, as well as quantitative and qualitative analysis of these data. The quantitative analysis and secondary data sources for the

landscape assessment was designed to provide current status of supply and demand gaps, and help frame proposed constraints faced by impact investors when examining nutrition focused value chain assessments. These constraints were tested by primary data collection from key informant interviews with investors as well as with value chain finance project delivery organizations.

Field research was conducted with:

- 10-15 impact investors and organisations promoting value chain finance - to develop & test the typology of proposed constraints and solutions
- Actors in horticultural supply chains in Java, Indonesia to illustrate how investment and financial services can strengthen businesses and supply chain relationships.

B. Body

1. Context

The FAO estimates that one in nine, or 815 million, people suffer from hunger on a daily basis. In addition, two billion people suffer from one or more micronutrient deficiencies or "hidden hunger" (FAO, 2017). The right to adequate food and freedom from hunger is defined through four dimensions that recognise the social, logistical and economic complexities inherent in ensuring all people have the physical and economic means to procure adequate and nutritious food (FAO, 2015). The four pillars of food security are 1) food availability, which entails a sufficient supply of food (both in terms of quantity and quality) in a specific area, 2) food access, which entails the ability to obtain food and which relates to available resources, markets and policies, 3) food utilization, which entails appropriate use of food in order to absorb nutrients and which relates to nutrition, safety and adequate sanitation, and 4) stability, which entails sustained food availability and access, and which relates to food resilience and environmental sustainability (ibid). These elements provide the basis for analysing the deficiencies in the food system that perpetuate food insecurity, and defining pathways to improve the way a food system operates. Historically the focus has been on increasing supply volumes of food, beginning with agricultural production yields (Gómez et al., 2013), which is required but not sufficient to address the formidable nutritional challenges that the world is facing today.

1.1. Nutrition and the Food System

Whilst the World Bank estimates that economic growth in the agricultural sector is twice as effective at reducing poverty as growth in other sectors of the economy (World Bank, 2007), improvements in human health and nutrition are not a given. Food systems change in line with a country's economic structural transformation process, influenced by changes in the role of agriculture in the economy, labour productivity, urban and rural demographics, and consumer shopping and dietary preferences. Through this development process nutritional challenges become more complex. Increased production volumes become less influential in providing for human nutrition needs. We know that *"just making more food available will not assure better food security, nutrition and health at the household and individual levels* (Pinstrup-Andersen, 2014). Critiques of the green revolution highlight the inadequacy of a focus on staple grains and caloric intake to meet contemporary, more complex nutritional challenges: *"But agricultural productivity growth of the major staple crops alone is not sufficient to*

address the nutritional challenges of today. Appropriate approaches necessarily vary across the four stages of food system transformation." (Gómez et al., 2013). As subsistence agriculture becomes less common, as the production of food for sale and processing grows, and the dietary transition from staples to non-staples intensifies, the importance of post-harvest, downstream supply chain activities become more important in influencing the nutritional quality of a food system.

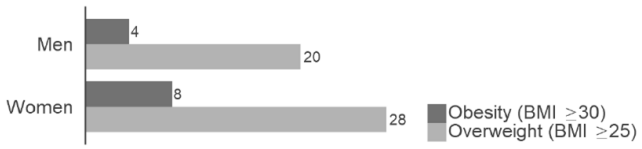
The triple burden of malnutrition and the dietary transition

Increasingly, the triple burden of malnutrition is observed in developing countries, with the presence of both over and under consumption of sufficient calories (obesity & undernourishment) combined with micronutrient malnutrition – at times observable in combination in a single household (Pinstrup-Andersen, 2007; Labadarios, 2005, (Gómez et al., 2013)). Diets trend toward including more processed foods with less fibre and micronutrient-rich foods, and more fats, oils, sugar and sweeteners, and health concerns shift from energy deficiencies and infectious diseases to challenges from excessive energy intake, overweight, obesity and associated chronic diseases (Gómez et al., 2013). Features of the globalizing food system that exacerbate obesity and over-nutrition concerns include a rapidly growing middle class with rising incomes in developing economies, urbanization, growing prevalence of cheaper convenience foods especially attractive to time-starved women; modern food retailers preference to sell packaged 'long shelf life' foods and growing foreign investment into vertically integrated food supply chains (Reardon & Timmer, 2014), (Pingali, 2007)). These features create pressures on health outcomes, but alongside the challenges they present new opportunities to engage with and supply desirable foods to consumers.

Malnutrition in children from insufficient calories and micronutrients is a significant challenge in Indonesia, the focal country of the case study in this research. The World Bank's most recent data from 2013 reports that 37.2% of children under the age of five are stunted and public awareness of this issue is low (Shrimpton & Rokx, 2013). Stunting can reduce an individual's productivity at a young age, their likelihood of going on to higher education, their earning potential and increases risks of developing non-communicable diseases when older (ibid). The 2017 Global Nutrition Report includes rates of adult overweight in Indonesia at 20% for men and 28% for women as shown in Exhibit 1 (Global Nutrition Report, 2017). The burdens of malnutrition affect more than individual people; economic losses due to stunting and malnutrition are estimated to ultimately amount to 2-3% of Indonesia's GDP from productivity losses and as non-communicable diseases place a greater burden on health systems (Shrimpton & Rokx, 2013). The World Bank partly attributes these nutrition challenges to an increase in national wealth accompanied by an increase in

food availability which has doubled the amount of fat consumed per capita. Processed foods are also being consumed in higher rates, particularly in urban areas (ibid).

Exhibit 1: Prevalence of adult overweight and obesity (%), Indonesia, 2014



Source: Indonesia Country Nutrition Profile, (Global Nutrition Report, 2017)

Agriculture for nutrition

Strangely, the overt link between agricultural production and nutrition has only recently begun to be discussed and researched - thankfully, given all human nutrition begins with the production of crops and livestock. The implementation approach termed 'nutrition sensitive agriculture' has received greater attention in the past decade. Defined by (Jaenicke & Virchow, 2013) thus:

> *"Nutrition-sensitive agriculture is a concept that expands the scope of the agro-food system to a system encompassing all elements from input delivery, production of food to distribution networks, storage, processing, retail and utilization including consumption with a special view to nutrition. Thus the scope expands from merely producing a sufficient amount of calories to taking into account vitamins, minerals and other micronutrients that are required for healthy living, environmentally sustainable food production, and food processing and utilization to ensure that the food reaches the consumers in an optimal state."*

Many works looking at the contribution of agriculture and food systems to human nutrition continue to take a "micro-view" by using household and individual access as the lens through which to examine pathways for improving nutrition (Remans, Wood, Saha, Anderman, & DeFries, 2014). A 2012 World Bank Health Nutrition and Population paper offers a set of eight guiding principles to assist in incorporating improved nutritional outcomes in design and investment into agricultural projects (Herforth, Jones, & Pinstrup-Andersen, 2012). Six of the seven principles look at household access and targeting, one seeks cross sectoral collaboration and only one addresses the macro requirement for year round supply of a range of diverse and safe foods. Pinstrup-Andersen offers a short critique on why little is being actioned on broader systemic change for nutrition: *"A second reason for lack of action to improve nutrition is the fixation of the health and nutrition community on randomised controlled trials (RCTs) as the only legitimate source of evidence"* (The Lancet 2013).

Jaenicke & Virchow 2013 do offer a more systemic analysis, and stress the value of nutrition sensitive agriculture in serving particularly vulnerable populations such as women, tribal groups, the elderly and children (Jaenicke & Virchow, 2013). Five 'entry points' are suggested: enabling policies (agriculture policy, human rights principles), mechanisms for collaboration across government ministries and between public and private institutions), awareness and capacity (on agro-biodiversity, with meaningful data and amongst decision makers who can influence large scale change), focusing on appropriate beneficiary groups, and elements along the food chain (inclusive of smallholders, extending to underutilised local crop varieties and livestock breeds).

Policies to improve the nutritional capacity of food systems are starting to move beyond the idea that quantity of food and caloric intake is the only contribution of agriculture to nutrition. New metrics have been proposed to allow comparison among different crops and production systems to evaluate nutritional value produced from a given land area. The metric of "nutritional yield" measures the number of adults who would be able to obtain 100% of their recommended Daily Required Intake of different nutrients for 1 year from a food item produced annually on one hectare (DeFries et al., 2015). The authors suggest the nutritional yield measure could guide land use decisions which outcome to prioritise: quantity of production or quality to produce essential dietary nutrients. Other pathways for improving nutrition include food production for one's own household consumption, gender specific time allocation, food availability through markets (quantity & quality), increased and diversified income, more accessible food prices, and consumer behaviour (Gómez et al., 2013). Modernizing systems should focus policy on integration of smallholders into higher value markets which strengthen demand for non-staples and modernising food chains (Pingali, Ricketts, & Sahn, 2015). This supports increased numbers of smallholder farmers and rural SMEs to either specialise in or diversify production and trade both within and beyond agriculture (IFAD, 2016). Each of these can contribute to increasing the availability and affordability of a diverse supply of micro-nutrient dense foods. These pathways contain a combination of systemic market approaches and changes in individual household behaviour, but start to acknowledge the importance of improved efficiencies in post farm-gate activities.

Recognising post-farmgate segments

Increasingly frameworks depicting links between agriculture, nutrition and food systems are recognizing the opportunities offered by mid-chain processes between agricultural production and consumer consumption. As pathways for influencing the food system are identified,

acknowledgement of how to serve actors in the mid-chain, often SME enterprises, is becoming more prevalent. The Global Panel on Agriculture and Food Systems for Nutrition (GLOPAN) recognise four drivers of the food system: agricultural production; food storage, transport and trade; food transformation; and food retail and provisioning (Global Panel on Agriculture and Food Systems for Nutrition, 2016). Notably, two of these four drivers could be classified as mid-chain functions, and begin beyond the farm-gate involving the economic activity of many non-farming food system businesses.

Hence increasing and improving micronutrient retention post farm-gate can improve health outcomes (Htenas, Tanimichi-Hoberg, & Brown, 2017), – in addition to improving the incomes of growers and supply chain actors and their employees. Whilst increases in income are important for food security (access),

> *'past research has shown that increased income alone does not automatically translate into better diets and nutrition. The impact of income on diets depends on the food environment (what kinds of food are available, affordable, convenient and desirable), and also on who controls the income'* (FAO, 2016).

Hence it is vital to consider the nutrient quantity, quality and diversity of foods handled at all stages of the food system – or supply chain. Agriculture for nutrition should really be agri-businesses for nutrition.

The importance of diversity in the foods system

Dietary diversification is important for nutrient intake and human health (Remans et al., 2014). A nutritious diet requires a food system supplying desirable and convenient fresh fruit and vegetables to consumers. National food supply diversity is associated with human health outcomes, irrespective of national income (Remans et al., 2014). Household expenditure on food is already diversifying away from cereals and towards processed foods. The challenge is to promote the nutritional value – the micronutrient density – of foods increasingly filling household shopping baskets. In Asia the dietary transformation has seen more of the household food budget spent on proteins – meat, fish, edible oils, horticulture products and animal source foods (eggs and dairy), away from staple cereals such as rice. (Reardon, 2015). This shift in diets away from cereals – In Indonesia less than one third (35%) of household food expenditure is on cereals – emphasises the importance of directing nutrition efforts to other food supply chains. Expenditure on fresh fruit and vegetables is 15% and 17% in Indonesian rural and urban households respectively (Reardon et al., 2014). This is consistent with other Asian countries (ibid).

National production and trade are two ways to increase diversity of the food supply. A cross-country study cited found that in low-income countries of a more diverse food supply is likely to be the result of the diversity of agricultural goods produced within that country, whilst food imports and trade are more correlated for high- and middle-income countries (Remans et al., 2014). The importance of production diversity in the food system is often highlighted in arguments promoting the need to move agricultural policy supports beyond the staple grains of the green revolution. Termed 'staple grain fundamentalism' (Pingali, 2015) claims policies such as irrigation infrastructure, input subsidies for particular fertilizers, credit subsidies for certain crops, or output price supports impede farmer incentives to diversify their production systems. Gomez, et al 2013 agree:

> *"Moreover, we must broaden the crop research agenda beyond staples and into micronutrient-rich fruits, legumes and vegetables, as well as into post-harvest processing and distribution issues. Following these actions would extend the cereals production focus of the Green Revolution to address micronutrient deficiency and overweight problems more effectively"* (Gómez et al., 2013).

However evidence shows that increasing household production of a crop doesn't necessarily change that household's eating habits, and increasing income doesn't necessarily increase consumption of foods. In Asia, horticulture and fish production are important for many households and, rather than being consumed are typically sold for cash to buy both alternative foods and non-food items (Reardon et al., 2014). Similarly, in a study on smallholder poultry production and food security in the Luangwa Valley, Zambia, the researchers found that increasing production of eggs in households did not lead to increased consumption of eggs, as households preferred to sell the eggs and use the income for other purposes (Dumas et al., 2016). Supporting this, a 2017 study in rural Ethiopia examined the contribution of purchased foods and subsistence crops to smallholder household diets, finding that 42% of calories consumed, with some seasonal variation, are from purchased foods. But more starkly, they find that during all seasons, purchased foods play a much larger role for dietary diversity than subsistence production, suggesting that markets are more important for smallholder nutrition than subsistence farming (Sibhatu & Qaim, 2017).

The role of fresh fruit and vegetables

The benefits to human health through a large presence of fresh fruit and vegetables in the food system is widely recognised (Keatinge et al., 2010). Under-consumption of fruit and vegetables is among the top ten risk factors leading to micronutrient malnutrition, containing a range of macro and micronutrients such as provitamin A, iron, and zinc, and is associated with the prevalence of chronic diseases (Keatinge et al., 2010). The World Bank recognise the importance of fruits and

vegetables in 30% of its recommended actions to improve diet quality, including the need to incentivise more public sector research on high quality and underserved foods (legumes, fruits, vegetables) to increase productivity and shift relative prices, encourage production of fruits, vegetables, and pulses and reduce food loss and waste of underserved nutritious food groups (especially fruits, vegetables, pulses, poultry, fish) (Htenas et al., 2017).

In Asia the majority of food expenditure is dedicated to non-grain products (including processed and animal source foods) (Reardon et al., 2014). In Indonesia less than one sixth of food expenditure is on fruits and vegetables (ibid). Thus, improving supply and stabilising prices though horticultural yield improvements and food market access is important for food security. Two important channels through which the production and export of fruits and vegetables has a positive impact on food security in developing countries are through the development of rural labour markets and female waged employment (Van den Broeck & Maertens, 2016). This is because horticultural supply chains embody particularly intensive use of low skilled labour in production and post-harvest activities, and are generally 'high value' crops. Rural households benefit through employment in integrated estate farming (mostly women) after the growth of vertical integration and consolidation, or through contract farming with export companies (mostly men) (Van den Broeck & Maertens, 2016). These effects are indirect and result from increased income availability. The positive effects will only result if prices of foods rise slower than incomes. Production for export can also affect food safety and sanitary standards that are generally applied across horticultural sectors. Excess supply produced to GlobalGAP standards may be released to the domestic market and a general increase in knowledge amongst producers can affect their production standards.

Private sector participation in value chains for development

At this point it becomes helpful to consider how producers can benefit from changing food systems through market participation, ie. integration into value chains. A value chain requires, by definition, examination of how private sector enterprises participate in production and supply of food to consumers. The private sector includes smallholder farmers and those small and growing enterprises that producers they sell to. The value chain approach involves identification of market-based interventions designed to increase the consistent supply of micro-nutrient dense foods, differentiate quality features, reduce losses and promote price stability. Strategies for value chain development seek to improve processes, productivity, new or improved products and coordination that can give actors – enterprises operating in the chain - the ability to increase income and effectively compete (D.

Ricketts, G. Turvey, & I. Gómez, 2014). Indications of a strong value chain include greater integration between fewer downstream actors, more sophisticated operations, known buyers, transactions backed by formal contracts, available information on volumes and qualities, and greater predictability of demand according to interviews conducted as part of the study.

The nutrition sector have examined how to engage the private sector in achieving nutrition outcomes, but at rather superficial levels, tending to group all models under the catch all term of Public-Private Partnerships (PPPs), and focusing on private sector multinationals (Kraak et al., 2012). The nutrition community's suspicion and 'extreme mistrust' of public sector engagement in nutrition initiatives, partly attributed to profit motives of corporations, has prevented effective partnerships that could shape systemic outcomes and improve the nutritional quality of entire food systems (Hoddinott, Gillespie, & Yosef, 2015). Per Pinstrup Andersen offers a short critique on why not much is being actioned on broader systemic change for nutrition: *"A second reason for lack of action to improve nutrition is the fixation of the health and nutrition community on randomised controlled trials (RCTs) as the only legitimate source of evidence"* (The Lancet 2013). Hoddinott, et al analyse different models for private sector engagement in nutrition, suggesting that PPPs can be contractual or non-contractual, and that the private sector can play roles of innovator and financier (Hoddinott et al., 2015). Given the multiplicity of private sector actors in food markets, from small scale producers, individuals, small business operators engaged in packaging, transport, distribution and local retail through to national or global corporates which may be public or private entities, the analysis seems extremely simplified.

The FAO analysed 39 public-private partnerships (PPPs) in agribusiness (Rankin, Nogales, Santacoloma, Mhlanga, & Rizzo, 2016). One third of these partnerships were termed meso-level as they sought to influence systemic level issues such as food security, rural economies or levels of private sector investment. It found that these value chain development PPPs generally focused on large-scale commodities with the aim of increasing productivity and quality levels to meet strong global demand. Interestingly, the value chain development initiatives placed most emphasis on the upstream - production – end of the chain, rather than processing, distribution and retail to domestic markets. Similarly, for projects on single value chains, the driver was enhancing capacity to meet specific food safety, traceability or sustainability standards in crops targeted for export (e.g. bananas, coffee and cocoa).

A more nuanced approach to analysing private sector participation in food systems is proposed by Gomez and Ricketts, acknowledging the differing roles that a private operator could fill – as product designer, processor or packager, distributer and/or retailer (Gómez & Ricketts, 2013). The authors propose four food value chain typologies that describe different participants, the types of products offered in different supply chains and the targets for any nutritional outcomes that could be delivered by interventions in each chain typology. The characterisations look at how modern food system actors interact with the traditional sector in modern, traditional, traditional to modern and modern to traditional chains.

Exhibit 2: Food Value Chain Typologies

Traditional	**Modern**
Traditional traders buy primarily from smallholder farmers, and sell to consumers and traditional retailers in wet, mostly local, markets	Domestic and multi-national food manufacturers procure primarily from commercial farms and sell through modern supermarket outlets
Nutritional Implications - Remains the avenue by which poor people access micronutrient dense foods. - However, seasonality and lack of infrastructure may limit nutritional impacts.	**Nutritional Implications** - Expensive micro-nutrient dense foods. For now. - Expansion of calorie-dense processed/packaged foods (especially in urban areas).
Modern to Traditional	**Traditional to Modern**
Domestic and multinational food manufacturers sell through the network of traditional traders and retailers (eg. 'mum and pop' stores)	Supermarket and food manufacturers source food from smallholder farmers and traders
Nutritional Implications - Expansion of calories via processed/packaged foods - Opportunities for fortification / bio-fortification of these products	**Nutritional Implications** - Direct participation limited to relatively better-off farmers - Indirect effects (e.g. off-farm labour) may be more important

Source: Adapted from (Gómez & Ricketts, 2013)

The typology specifically considers food access – availability & affordability – as mechanisms for positive outcomes on malnutrition in modernising developed country food systems. Both positive and negative effects are possible for these chains on different populations. For example, intensive processed and packaged food distributed by modern manufacturers through traditional retailers can contribute to over-nutrition in urban areas, but could reduce undernourishment in remote rural areas. Similarly, indirect nutritional effects for small traditional producers selling to modern retailers may result from increased farm income or off farm employment opportunities. The authors

conclude by strongly suggesting that that more empirical research must be done on the impact of food value chain transformations on micronutrient deficiencies, particularly for smallholder farmers and rural populations. (Gomez and Ricketts, 2013)

In addition to different functions (producer, product designer, processor or packager, distributer, retailer), the private sector encompases enterprises of all different sizes from tiny smallholder producers to multinational food companies. In the middle are millions of small-medium sized local businesses, serving local populations, employing local people, borrowing from local banks and utilizing locally available technology.

Typically, a value chain approach to development begins with a focus on a specific market and commodity, examining inefficiencies in that supply chain or enabling environment, and how to increase inclusiveness for target populations such as smallholder farmers or women. This approach, whilst considering the economic benefits for actors in that chain, remains a step away from examining the needs of actors connected across the entire food *system* which may display deficiencies in providing required micro-nutrients or excess calories to a wider set of consumers - producers, employees, rural and urban residents. In response, recent work proposes the integration of 'nutrition sensitivity' into value chain work.

Utilising a value chain perspective as a lens for food systems analysis has prompted frameworks for seeking improved nutrition outcomes from supply chain interventions. A useful typology is presented by Gelli & Hawkes who suggest that mapping high or low supply of nutritious food against high or low demand provides pathways for harnessing a value chain intervention to enhance the dietary nutrition (Gelli et al., 2015). The authors characterise 'impact pathways' options as 1) promote consumption 2) increase supply and/or 3) improve chain efficiency & nutrition (quality, safety, low and stable prices) and then suggest appropriate indicators for assessing impact. In Oct 2016 the Committee for World Food Security took this foundational work and suggested a common conceptual framework for the Rome Based Agencies Working Group on Sustainable Value Chains for Nutrition to use (Committee on World Food Security et al., 2016), notably starting to shift target beneficiaries of interventions from producers to consumers.

The Rome Based Agency's Committee on World Food Security framework on Nutrition Sensitive Value Chains (NSVC) propose a more system-wide view of nutrition needs to guide selection of particular commodities that will address nutrition deficits. They propose 4 different strategies

depending on how supply and demand for those foods interact. For example, high demand and inconsistent supply suggests a need to focus higher up the chain on production, processing and distribution. It recommends selecting commodities that will impact both producers and consumers as target groups, and extending target market selection to traditional markets where the nutritionally vulnerable buy their food (Committee on World Food Security et al., 2016). Applying a NSVC analysis suggests a focus on fresh fruit and vegetable supply chains is valid.

Making Investments and capturing value

Nutrition sensitive value chain methodologies focus on the viable pathways or entry points to increase both supply and demand of nutritious foods, to reduce loss along the chain or increase nutritional value. The FAO has gone some way to identifying the types of investments that are likely to produce nutrition outcomes. Exhibit 1Exhibit 3 below provides examples such as investing in storage and transportation, or on farm irrigation and drainage infrastructure (FAO, 2016). Often the term investment is used to refer to both public and private sector spending (FAO, 2016), (Nugent, 2016). The missing link when referring to private sector investment is identifying who – which farmer, enterprise or small business operator - is expected to make the investment, and what financial benefit – profit - may be returned to them to compensate for taking on debt and risk from adopting new practices.

Exhibit 3: Example of 'investment opportunities' to produce nutrition returns

		FOOD ACCESS, DIETS and health					
Investment project types	**Entry points**	**On-farm food availability & diversity**	**Food environment in markets**	**Income**	**Women's empowerment**	**Nutrition knowledge & norms**	**Health & sanitation environment**
Agriculture development (extension research, area development inputs)	**Agriculture intensification**	Meet dietary gaps through own production	Increase availability and affordability of nutritious foods and diets in markets	Increase equitable access to resources and income; reduce poverty	Increase women's access to resources, know-how and income; reduce labour and time burden	Increase awareness/ Behaviour Change Communication (BCC) of nutritious foods and diets	Improve food safety, e.g. reduce mycotoxins & contamination (e.g. from agrochemicals)
	Agriculture diversification						
	Livestock and fisheries						
	Extension -Farmer field schools						
Value chain development (including agro-processing)	**Storage & transportation**	Increase on-farm and off-seasonal availability of targeted nutritious crops	Increase variety in local markets, reduce prices & postharvest losses & improve convenience of nutritous foods	Increase income from value addition and technial expertise; reduce poverty	Increase women's access to resources, know-how and income; reduce labour and time burden	Increase awareness/ BCC of nutritious foods and diets and retaining nutrient content	Improve food safety, and food standards
	Processing						
	Trade & market linkages						
	Marketing & promotion -Nutrition focused marketing						
Community-Driven Development (CDD)/Social development	**Rural institutional development** - Women's self-help groups - Capacity development	Increase crop productivity and diversity food subsidies & distribution; households gardens	Strengthen storage, processing and retail of nutritious foods in markets	Increase equitable access to resources and income & enable savings and strategic investments; reduce poverty	Enable equitable decision-making; increase women's access to resources, know-how and income; reduce labour and time burden	Increase nutrition knowledge/BCC including awareness of healthy diets	Improve hygiene and sanitation practices and infrastructure
	Social activities - Community facilities - Social development/WASH						
	Financial inclusion/livelihood activities - Income generating activities						
Water, irrigation and drainage	**Irrigation and drainage**	Increase crop productivity and diversity and off-season production	Increase off-season availability & affordability of nutritious foods in markets	Increase crop production and income; reduce poverty	Reduce time burden from obtaining water		Reduce risk of waterborne and vector-borne disease; increase access to clean water
	Water for domestic use - Drinking water - Hygiene and sanitation						
	Water management						
Natural resource management/ Forestry/ Environmental	**Biodiversity promotion**	Sustain biodiversity for diet diversity; traditional indigenous and underutlized food species; Non-Timber Forest Products (NTFPs)	Increase availability of nutritious and underutilized foods in markets	Decrease risk of disasters/ catastrophic income loss (resilience)	Increase access to resources and income; reduce labour time and burden		Reduce environmental risks for food items (contamination)
	Climate smart & nutrition sensitivity win-win						
	Soil rehabilitation						

Key	Green = important entry points to leverage and measure	Yellow = potential contribution requiring attention; measure if addressed	Blank = typically less of a direct contribution, although linkages may be possible; can be measured to ensure no harm

Source: Compendium of indicators for nutrition-sensitive agriculture, FAO 2016

The Rome Based Agency's Committee on World Food Security in their 43rd session backgrounder document acknowledge that nutrition sensitive value chains must recognise the definition of 'value' as extending to both economic and nutritional value (Committee on World Food Security et al., 2016). We can strengthen the case for investing for improved nutritional outcomes by overtly recognising and quantifying the financial rationale – payoff – possible for a specific enterprise or actor making an investment ie. expending money or time to change practices. Economic value must be captured by an entity in order to underpin an actual investment of funds. A value chain is comprised of a large number of private sector enterprises, often small and medium in scale, who must perceive this financial rationale for taking on the risk of changing practices or purchasing new equipment. This clear return proposition is especially crucial when those private sector participants are also those bearing the greatest nutritional and food security risks.

Currently, nutrition focused interventions are not being presented as investible solutions, but the USD 2.7 trillion annual gap in finance required to realise the SGD goals by 2030 (UNCTAD, 2014) is not going to be filled without private sector investment. A reasonable, believable business case

that identifies the risk/return trade-off is required by both wholesale financiers and the millions of individual enterprise owners operating in the food system.

1.2. Smallholder Farmer Participation

Of course the point of seeking inclusive rural development and better nutritional outcomes through food system transitions is to serve the most vulnerable, and in most countries that group includes families dependent on agricultural production for at least some of their income and food. Based on an assessment of 29 developing countries, Webb and Block (2012) suggest promotion for agricultural productivity must target support to smallholder agriculture in order to mitigate risks of the triple burden of malnutrition, particularly obesity and associated chronic diseases in rural areas. They propose that increased wealth alone will not lead to better nutritional outcomes; stunting declines at a faster pace for countries supporting and sustaining agricultural development through focused policies aimed at smallholders. Others have suggested that there has been too much focus on smallholder farmer productivity and integrating them into to value chains directly, when the potential for indirect benefits from employment in more commercial operations – farm employment, food processing or distribution services – also build the rural economy (Gomez, Mabaya, & Wilson, 2015). What is common is agreement on the importance of supporting smallholders and their rural neighbours - as consumers of food - to participate in growing economic activity through production and sale of crops, and through off-farm business development and employment (Gómez et al., 2011)..

Enabling smallholder participation in markets is facilitated by linking them to a supply chain that will ultimately deliver their produce to a consumer. Research is beginning to consider how interventions targeted towards actors further along the food chain, alongside focused support for smallholders themselves, can also better enable inclusion of poor growers, strengthen trading relationships and provide greater opportunities for both producers and other supply chain actors. This process can facilitate economic structural transformation through the transition of labour out of farm production activities and into industrialising employment, either within the food system, for example in processing, or in supporting functions such as transport (McCullough, Pingali, & Stamoulis, 2010).

Enhancing the inclusiveness of value chains as a development tool to benefit smallholder farmers and rural communities is examined comprehensively in a 2016 IFPRI publication, "Innovation for

Inclusive Value Chain Development" (Devaux, 2016). Summarising research from others, the book highlights that millions of low income people participate in value chains as producers, traders, processors, retailers and consumers, and that "improving the performance of agricultural value chains stands to benefit large numbers of people" (Reardon and Timmer 2012; Reardon et al. 2012; Aramyan, Lansink, and van Kooten 2005; Lohman, Fortuin, and Wouters 2004; Lambert and Pohlen 2001). Benefits of inclusive value chains for producers and rural populations are familiar and include increases in agricultural output, income growth by producing higher value fruits, vegetables, dairy, and animal-source foods of higher standards, and job generation in rural communities. Benefits for consumers include a greater supply of more diverse, nutritious foods, year-round access to previously seasonal foods, increased food safety, and reduced food costs due to competition and longer supply chains that allow sourcing from productive zones farther afield and those with the greatest comparative advantages (Reardon, 2016). This book, whilst highlighting the role for other actors down the chain who are often poor small traders or enterprises themselves, does not address the need for finance for those actors. Strangely, finance and credit is mentioned as necessary for producers but not for other actors in the chain.

Unsurprisingly, IFRPI Indonesian research on chilli's and tomatoes confirms that moving up the value chain or along the 'product cycle' from bulk commodities to differentiated quality or better varieties will earn higher incomes for small growers, plus benefit wholesalers and local wage labour hired to harvest, clean, sort, package and transport products (Minot, 2013), (Hernández, Reardon, Natawidjaja, & Shetty, 2015). These findings were based on an econometric and empirical study on chili farmers in Indonesia that proved that participation in supermarket channels is associated with higher incomes (Sahara, Minot, Stringer, & Umberger, 2015). The study notes similar findings in other research by Miyata et al., 2009; Neven et al., 2009 and Rao and Qaim, 2010.

Reasons why smallholders do or do not participate in markets – ie. sell their produce – have been examined in existing research (Umberger, Reardon, Stringer, & Loose, 2015). One strand of research considers smallholder situations specifically – their transaction costs that may prevent them from selling crops. Another strand of research considers how producers may innovate to overcome transaction costs by entering into contracts, acquiring credit or learning new technologies. A further area of enquiry considers which market channel producers may choose to sell into, eg. traditional, large processors or modern – but bases the findings on features of the grower (eg. assets, or size or context) rather than the supplier (Umberger et al., 2015).

IFRPI Indonesian research on chilli's and tomatoes looked at determinants of participation in supermarket channels and found that education, training and location – distance from major roads - are more important than farm size or equipment for farmers to enter modern market channels. However in contemporary Indonesia this affects a small number of farmers, as 95% of fresh chillis in Indonesia are sold through traditional wet markets (Sahara, Minot, Umberger, & Stringer, 2013). Interestingly, few observations were made in the IFRPI Indonesian studies on access to finance for producers of high value crops, or for other actors in those supply chains, for example through value chain finance products such as input credit from traders or contract payments from buyers (Sahara et al., 2013). The IFPRI Global Food Policy Report 2015 examines agricultural finance, including a chapter on smallholder family farming, and a typology of market evolution to guide whether improved access to financial services is an effective policy mechanism for supporting the profitability of small family farms (Fan, Brzeska, & Olofinbiyi, 2015). This preoccupation with producer finance is representative of most food systems and agricultural development texts; the opportunity to support and invest in other actors in the supply chain is not receiving enough attention.

Summary - composition matters across the entire food system and for individuals

Compelling findings support the case for private sector investment in agri-food enterprises to improve nutritional quality of a food system through a systemic focus on the supply side of fresh fruit and vegetable markets. Attention on the composition and diversity in the food system from agricultural production through to individual household food baskets is critical to support nutritious diets and health outcomes. The growing middle class and their rising household disposable incomes correlate with a rising portion of food budgets being allocated to more processed, less healthy foods and an increased proportion of food expenditure spent in modern food retailers. Policy makers and investors should pay attention to the quality and quantity of micronutrient dense foods such as fruits and vegetables, not just staple cereals, arriving on individuals' plates. To enhance food security, it is important to support smallholder farmers to participate in growing economic activity through production and value addition of horticultural crops, and through off-farm employment.

What is less clear is the rationale that will induce informal and formal private sector enterprises engaged in production, processing, distribution, and retail to also contribute to these nutrition enhancing food system changes. Making the business case – identifying where a private enterprise can capture economic value will promote more alignment, activity and investment. When a viable

business model can be demonstrated, private sector funding for investments along the chain will be more accessible. Discussion of the business drivers for investment into fresh fruit and vegetable supply chains follows the next two sections which examine the role and expectations of finance as an enabler in agri-food systems.

2. Definitions and scale: Impact Investment, the Finance Supply Chain and Agri-Finance

Given the potential for generating positive food security and nutrition impacts from promoting further production and trade in fruit and vegetable supply chains, this paper focuses on the role that impact investors can have in increasing investment into these sectors.

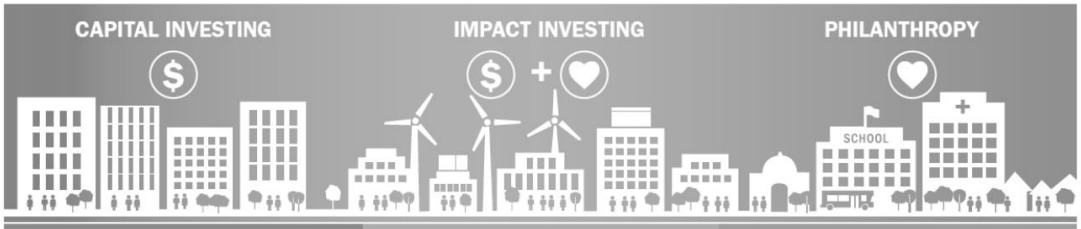
Appropriately tailored financial products are an essential feature of a supportive enabling environment for businesses in the food system, from agricultural producers through to retailers and all those intermediaries in between. External finance (as opposed to self-funding from accrued profits or informal sources) is crucial to allow businesses to manage cash flows in regular operations, to invest in new technology and improve operations, or to trial innovations in products, services or business models (International Finance Corporation, 2010). This external funding may be provided by the formal financial sector, ie. registered banks, microfinance institutions for smaller micro-businesses, finance companies which generally provide credit for working capital purposes or asset purchases, or equity investors supplying longer term growth capital for larger businesses. Financial products and services include equity, short and long term credit, asset and trade finance, risk management mechanisms such as insurance or guarantees, savings products, and remittance and transaction services that improve the efficiency and trustworthiness of transactions. In this analysis, the term investment typically refers to both wholesale and retail debt and equity capital.

2.1. Impact investment

To appreciate why we focus on the role of impact investors and how to address any barriers to greater participation in diversified agri-food supply chains, it is useful to consider how impact investors differ from traditional investors. Broadly, impact investors seek not only to generate positive financial returns but to also realise positive social or environmental returns as a consequence of their investments. The Global Impact Investing Network provides this definition "Investments made into companies, organizations, and funds with the intention to generate social and environmental impact alongside a financial return"(Global Impact Investing Network (GIIN), 2017). Impact investments provide the means to address social and environmental issues for an expanded range of funders beyond traditional philanthropic donors. These non-financial outcomes could include, for example, improvements in smallholder farmer income and livelihood opportunities, or nutrition and health outcomes for vulnerable populations. Increasingly impact investment strategies are being expressed in line with the Sustainable Development Goals; most

commonly sought goals are SDG #1 No poverty, SDG 13 Climate Action and SDG #5 Gender Equality (Global Impact Investing Network (GIIN), 2017). Because the impact investor seeks long term sustainability of social outcomes through the investee enterprise, they often also provide or fund technical assistance such as strategic and business planning and operational design services. An impact investor can be characterised as sitting between traditional investors and philanthropists as depicted in Exhibit 4 below.

Exhibit 4: The spectrum of investors, capital and enterprises



Investing that deploys capital with the anticipation of generating financial returns to the investor but **no expectation** of generating positive social and/or environmental impact.			Socially motivated investing that deploys capital with the anticipation of generating financial returns to the investor **alongside** positive social and/or environmental impact.		Socially motivated funding that deploys capital with the anticipation of generating positive social and/or environmental impact for society but no financial returns to the funder.	
	SOCIALLY NEUTRAL INVESTING					
Mainstream Investing	**Socially Responsible Investing (SRI)**	**Sustainable Investing (ESG)**	**Non-Concessionary Impact Investing**	**Concessionary Impact Investing**	**Venture Philanthropy**	**Charitable Giving**
Investing in companies without consideration of social or environmental impact	Using a negative investing screen to exclude companies considered ethically problematic	Using a positive investing screen to include the environmental, social and governance (ESG) considerations of companies	Investing that seeks measurable social impact alongside risk-adjusted financial returns	Investing that is willing to make some financial sacrifice—either taking greater risks or accepting lower returns—to achieve social goals	Funding non-profit social enterprises that generate some or all of their revenues from business activities	Funding non-profit social enterprises that rely completely on charitable donations

Source: Bringing Impact Investing Down to Earth Insights for Making Sense, Managing Outcomes, and Meeting Client Demand 2015.pdf Buckart

There are no definitive boundaries defining what is or is not an impact investor, or what level of social return must be sought or demonstrated from an investment to validly claim the label. Individual Impact investors range across the risk and return spectrum, in that each may place a differing priority on the financial and social returns sought, and on the risk profile they are willing to accept. Commonly accepted characteristics of impact investments are the intention to generate positive social or environmental impact, and a commitment to measure and report performance of these impact goals ("The GIIN: What You Need to Know About Impact Investing," n.d.).

The global volume of funds currently directed towards impact investments is sizeable. The Global Impact Investing Network's 2017 Annual Survey reports estimates of USD $114 billion in assets

under management at the end of 2016 from self-identified impact investors (Global Impact Investing Network (GIIN), 2017). As this is a self-reported survey, this volume is considered to be a conservative estimation. The investors are diverse and include for-profit and not-for-profit fund managers, foundations, DFIs and pension funds, amongst others (ibid). The number of separate deal transactions in 2016 is significant at close to 8,000, and is expected to grow by 20% in 2017 (Global Impact Investing Network (GIIN), 2017). The most common sectors into which funds are deployed are housing, energy and financial services including microfinance. Over one-third is directed geographically into the US and Canada, and only 8% to South and South East Asia combined. The Food and Agriculture sector attracts a small portion of these investments, 7% of assets under management (Global Impact Investing Network (GIIN), 2017). However very little of these funds are directed towards fruit and vegetable supply chains as detailed in Section 3, Data: Supply and Demand of Finance to the Agri-food Sector and SMEs. The reasons for this are examined in detail through interviews with investors in Section 3.3, The Investor's View on Domestic Markets, Crop Selection and Nutrition (Interviews).

Impact investments are often characterised by blended capital. Blending capital is a strategy to increase the volume of funds directed towards social and environmental goals. Funds from these multitude of actors are combined into a single structure or project, an approach that allows investors with differing risk and return expectations to jointly make investments. Blended finance is defined by the World Economic Forum as "the strategic use of development finance and philanthropic funds to mobilise private capital flows to emerging and frontier markets" (OECD, 2015); participating funders can include development finance institutions (DFIs), governments, foundations, private investors, and/or impact investors. Features that distinguish blended capital from pure donations or from pure return-seeking capital are the combined presence of three characteristics: leverage, social impact and financial return (OECD, 2015). The potential to leverage large volumes of private capital to address significant challenges such as climate change adaptation or sustainable food systems is considered essential to make significant progress on the global goals (OECD, 2015). Recent growth is encouraging: between 2012 and 2014 private investments mobilised by blended finance grew by around 20% annually (Business and Sustainable Development Commission & Convergence, 2017). It is difficult to measure the total volume of funding currently utilising a blended capital approach to address social or environmental issues; recent publications from the OECD, WEF and the Business and Sustainable Development Commission cite amounts

ranging from USD $25 billion to $81 billion (Business and Sustainable Development Commission & Convergence, 2017).

Blending capital can be achieved through both formal and informal structures, and may utilise different investment products or asset classes to attract this greater volume of funding, to de-risk an investment for the private sector, and/or align cash flow timing requirements for participants. A formal structure may utilise common financial instruments such as equity and subordinated debt. For example a long-term or philanthropic investor with a higher risk appetite may provide the equity, a foundation may make a program related investment into junior or below-market rate debt, and an investor seeking regular cash flows and higher return may provide senior debt. The presence of the equity investors serve to de-risk the investment, and this first loss capital can be leveraged to attract greater volume of less risk tolerant, market-rate seeking funds. Alternatively, a more informal structure could look like a project where an NGO may fund technical assistance, project design or education components with a grant, serving to reduce operational risk, and another return-seeking participant may fund the investment component. This technical assistance and design are not direct investments in the capital structure, but do increase a project's probability of attaining its targeted financial return (Business and Sustainable Development Commission & Convergence, 2017). A public-private partnership (PPP) may be considered another form of blended finance, where participants include governmental agencies alongside the private sector, NGOs, and in agri-PPPs, even producers and small-medium agri-food enterprises (SMAEs) themselves. In agri-PPPs financing structures can include co-equity investments, grants or concessions for the private sector and in-kind services alongside national funding (Rankin et al., 2016). Agri-PPPs can promote value chain development, technology transfer, or agricultural market infrastructure, both off-farm (agro-processing, manufacturing and processing facilities, marketing and trading hubs) and on-farm (irrigation, storage, energy, transport) (ibid). Public benefits that attract governments are a particular feature of PPP's, beyond sharing risk, return and investment contributions between all parties (ibid). The FAO finds that including financial institutions into a PPP agreement is a critical benefit of agri-PPPs (ibid), reinforcing the opportunity to build supply of capital to those financial institutions at the end of the finance supply chain.

Reducing risk and bolstering returns for private capital is one of the most valuable elements of a blended finance structure. The most recent study of trends in blended finance deals totalling over USD $51billion, conducted by The Business and Sustainable Development Commission, recognise both grants and subordinated financial instruments as crucial. After reviewing OECD, WEF, and

Convergence Database information, the study identified four common instruments: 1) junior/subordinate capital, 2) guarantees and risk-insurance mechanisms, 3) donor-funded technical assistance facilities, and 4) design or preparation grant-funding (Business and Sustainable Development Commission & Convergence, 2017). In this study, '73% of blended finance deals deploy either i) junior/subordinate capital, ii) a technical assistance facility, or iii) both together' (ibid). Technical assistance, often funded via grants, is recognised not only as a mechanism to reduce risk, but also to build the capacity of investees and lower origination and transaction costs for investors, evidenced by inclusion in at least 50% of blended finance deals (Business and Sustainable Development Commission & Convergence, 2017).

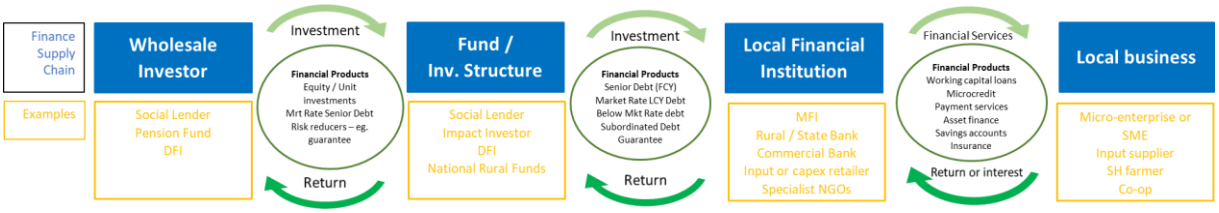
Two additional benefits of blended finance structures particularly applicable to food and agriculture sectors include demonstrating the viability of business models in under-penetrated markets, and lengthening the time horizons for capital providers to realise returns, which can then improve or lengthen terms for borrowers (OECD, 2015). However these benefits are not being realised, with only 1% of capital mobilised through the USD $51 billion of blended finance deals directed to the agricultural sector (Business and Sustainable Development Commission & Convergence, 2017). Another 15% went to financial services (ibid), some of which may have ended up in agri-food sector businesses. However this proportion is still relatively small.

Priority development outcomes common in the impact investing sphere are demonstrated by looking at the Global Impact Investing Network's catalog of IRIS metrics. Across the impact investing industry many utilse these generally accepted performance metrics to measure and report on social, environmental and financial success (Global Impact Investing Network, 2017). This collection of agreed metrics reflects the historical focus of agriculture as a driver of economic and livelihood outcomes, farmer productivity and income growth, rather than a contributor to food security through diversity, nutritional quality, availability, reliability, or micronutrient composition of the food system. IRIS metrics for impact investments into agriculture include units sold or purchased from smallholders, prices, premiums, and yields; defining the crop type is only one of 30 measures (Global Impact Investing Network, 2016). The health category includes metrics for treatment rates and utilization of healthcare facilities, but no metrics on diet or nutrition. Whilst developing a strategy around how an impact investment will deliver positive change requires deeper articulation of what outcome is being sought, for whom, how deeply and for how long (Impact Management Project, 2018), the absence of food security and nutrition indicators suggests a low level of familiarity with food security and nutrition outcomes for this sector.

2.2. The finance supply chain

Increasing supply of finance to downstream enterprises requires understanding the gaps in, and priorities of actors at, different levels along the 'finance supply chain'. Exhibit 5 shows a simplified version of this chain: wholesale suppliers of finance provide market or below-market rate debt or equity into funds which then deploy capital into local financial institutions who then on-lend to local businesses. The source and character of an investor's funding supply will influence its own portfolio construction. A funder will define its risk appetite, and financial and impact returns required from its 'downstream' or onward lending and investment activities. Hence each actor must generate surplus from its investments in order to cover its own financing costs and to meet the upstream investor's financial and social risk and return expectations. Cross border financing adds an additional cost to borrowers as the cost of capital must cover foreign currency hedging costs. However cross-border funding remains an important source for maturing capital markets where domestic/local sources may not yet be able to supply longer maturity debt (Hailey, 2017). In short, each actor in the finance supply chain must prove they can execute a solid business case for return and risk mitigation to present to its own investors and creditors.

Exhibit 5:Example finance supply chain



Source: Author's own creation

An impact investor may be operating as a wholesale investor, fund manager or even direct investor into local businesses. This is a simplified categorisation of organisations and financial products present in the finance supply chain. When we expand to organisations that can participate in impact investment, we can include institutional investors, NGOs, multilateral development banks, national development finance institutions, aid agencies, donors, private foundations, commercial banks and insurers (Business and Sustainable Development Commission & Convergence, 2017). Each of these actors will define its priority dimensions for investee performance differently. A wholesale investor may expect forecasts of cash flows in and out of an investee operation, capital appreciation, annual profitability and options for exit. An investor directly providing longer term growth capital to an

agri-business (at the right end of the chain) will also expect a viable business case with reasonable strategies on how to ensure steady supply of inputs, maintain quality in operations, grow market share, reduce costs – all of which influence profit. Hence to increase supply of funding, it is a matter of understanding the priorities on volume, return expectations and risk tolerance of the funding provider. This perspective helps in identifying how to focus efforts to increase the supply of funds to downstream small businesses operating in the food environment.

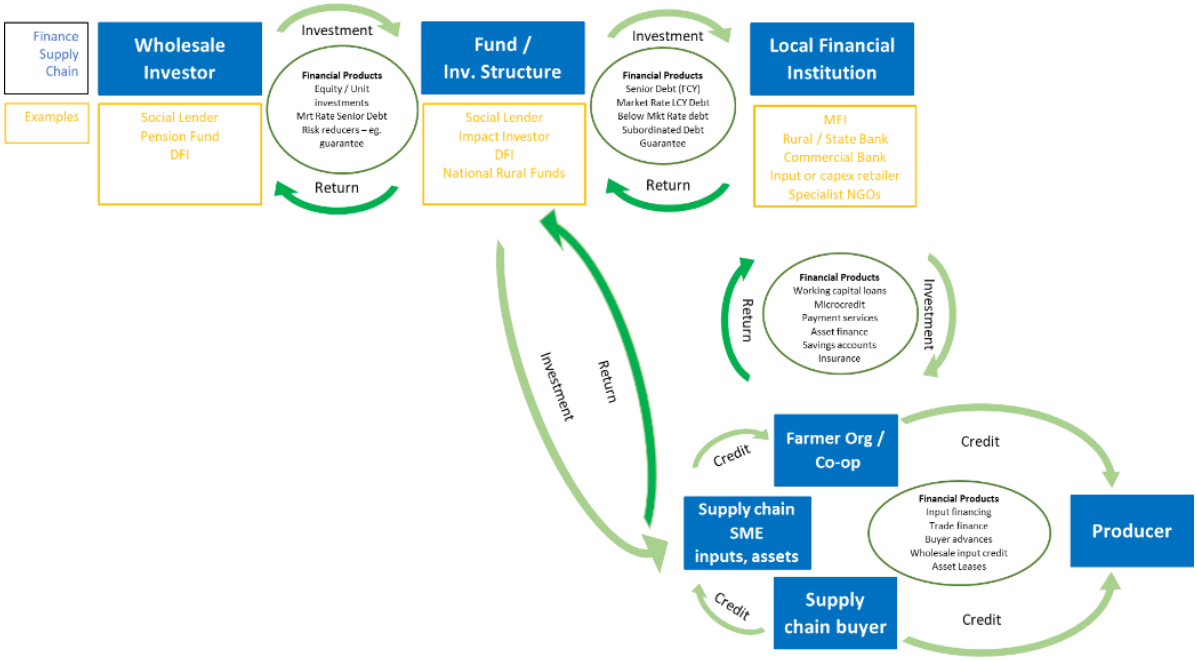
2.3. Value Chain and Agri Finance structures

In the realm of agricultural finance there are more complex or intricate relationships between financiers and supply chain actors at the end of the food supply chain. The FAO describes agricultural value chain finance as 'the flows of funds to and among various links within a value chain', covering 'financial services, products and support services flowing to and/or through a value chain to address the needs and constraints of those involved in that chain, be it to obtain financing, or to secure sales, procure products, reduce risk and/or improve efficiency within the chain' (C. Miller & Jones, 2010). Supply of finance comes not only from financial institutions but also supply chain actors themselves. Examples include the extension of credit directly to producers, or alternatively to input suppliers on behalf of producers, backed by contracts over future crops as security. **Error! Reference source not found.**Exhibit 6 presents these relationships and some example financial products. These arrangements often develop as a strategy to reduce risks from future price fluctuations or uncertain volumes and quality of raw materials for buyers and can assist producers to manage higher cash flow demands in planting season. Financial institutions or funders may supply capital directly to farmer co-operatives that aggregate output from individual producers, or to small processing or transport businesses operating along the food supply chain. Each actor requires access to tailored financial products in order to trade with their suppliers, on-sell to buyers or manage cash flow.

Supplier credit is a common source of finance for many SMEs around the world (International Finance Corporation, 2010). Buyers and multinational offtakers provide significant trade finance or supplier credit, and are more likely to fund value chain finance services from their own balance sheet, sourced at market rates. Commercial banks may utilise customer deposits, again, effectively sourced at market rates (ibid). Certain dedicated financial service providers such as MFIs, State Banks or Social Lenders can support higher risk tolerance in their own portfolios as their own sources of funding tend to be below market rate debt, higher risk tolerant equity, grants, or

government subsidised finance, (ISF, 2016). Appendix D shows types of capital typically accessed by different types of financial services providers.

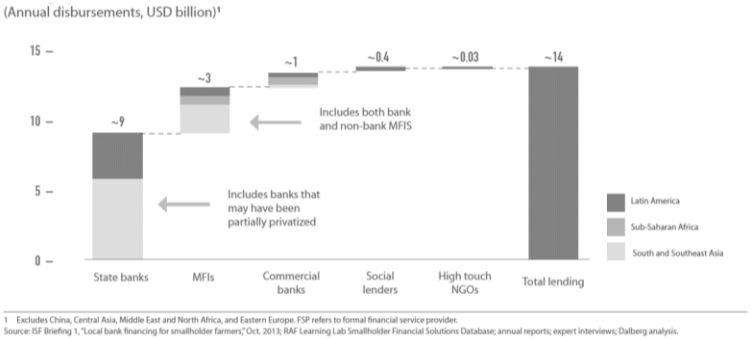
Exhibit 6: Agri-finance supply chain relationships



Source: Author's own creation

According to research by the Initiative for Smallholder Farming, most of the supply of external funding that reaches producers is provided through formal financial institutions or value chain actors themselves (ISF, 2016). Of $56bil in total lending reaching smallholder farmers in developing countries, $14bil is supplied by formal financial institutions (including state banks, MFIs and agri-finance impact investors), $17bil from value chain actors, with the balance coming from informal or community based lenders (ibid). The breakup of lending from FFIs is depicted in Exhibit 7. Agri-finance impact investors, or 'social lenders' typically focus on cooperatives or producer groups comprised of smallholders as aggregation provides economies of scale and a central body to coordinate individual loans, repayments, produce delivery and communication with members. The portfolios and priorities of these impact investors are examined in detail in Section 3.2 below.

Exhibit 7: Lending by formal financial institutions in South and SE Asia, SSA and Latin America



Source: (ISF, 2016)

Four typical value chain finance models amongst agri-food actors have been observed and categorised according to the characteristics of different value chains: tight VCF with consistent output buyers; loose VCF with output buyers; nucleus farm out-grower models; and VCF through input suppliers (Varangis, Hess, Teima, Khan, & van de Velde, 2012), (ISF, 2012). The prevalence of credit from buyers and input providers highlights the importance of supporting these actors with appropriate finance solutions for their businesses in addition to the focus on direct smallholder credit (IFC, 2012) (IFC, 2015) (Initiative for Smallholder Finance (ISF), 2015).

2.4. Financial products for agri-businesses along the FFV supply chain

In the same way that all private sector economic activity requires injections of capital, businesses along the horticultural chain can be constrained by supply shortages of finance matched to their return horizon and risk profile. Farmers and SME agri-food enterprises in an individual value chain may differ broadly in the financial services or value chain arrangements most appropriate for them, depending on their commercial maturity, size, assets, business model and potential types of security (collateral) available to underpin lending. Agri-finance products and value chain finance arrangements generally have three goals: to mitigate risk for the lender and borrower, reduce transaction costs and/or utilise new forms of collateral (Varangis et al., 2012). Categories of collateral in value chains involving smallholder finance include a farmer or co-operative's business operations itself (expected cash flows, savings or group guarantees), moveable assets (equipment or the stored commodity), and buyer relationships (through formal or informal contracts) (ibid).

Agricultural sector SMEs not involved in the primary production side (i.e., traders, processors, input suppliers) have their own financing needs just like any other SMEs. Working capital, funding for acquisition of assets (movable and real estate), cash flow management services, and insurance are common requirements of these food value chain SMEs (Varangis et al., 2012).

The financial products most important to agricultural and food businesses are those that support purchase of inputs for production, trading relationships (ie. repeated purchase and sale of goods), and investment in fixed assets. Traditionally, credit for these purposes required the borrower to provide some form of collateral – an asset to secure the debt in the event the lender is unable to make repayments. However small-medium producers and agri businesses may not have legal title on assets they utilise in their business. Often land users are not the official title holders and cannot use land as collateral for loans. Hence mechanisms have developed where the commodity or crop being traded is used security for loans. Trading relationships along the supply chain can utilse a contract for sale as security for a specialised trade financing arrangement. Input value chain finance is where the supplier offers a high-quality agricultural input for sale to farmers and may receive payment directly from the buyer when the farmer sells their cash crop after harvest. In more mature markets specialised agri-insurance products are available more widely, however in developing countries weather and index based insurance producers are largely in the pilot phase and have not reached mass scale as yet. Typical credit and transaction finance arrangements in the agricultural sector are described in Table 1.

Table 1: Common financial products and services for agri-food enterprises

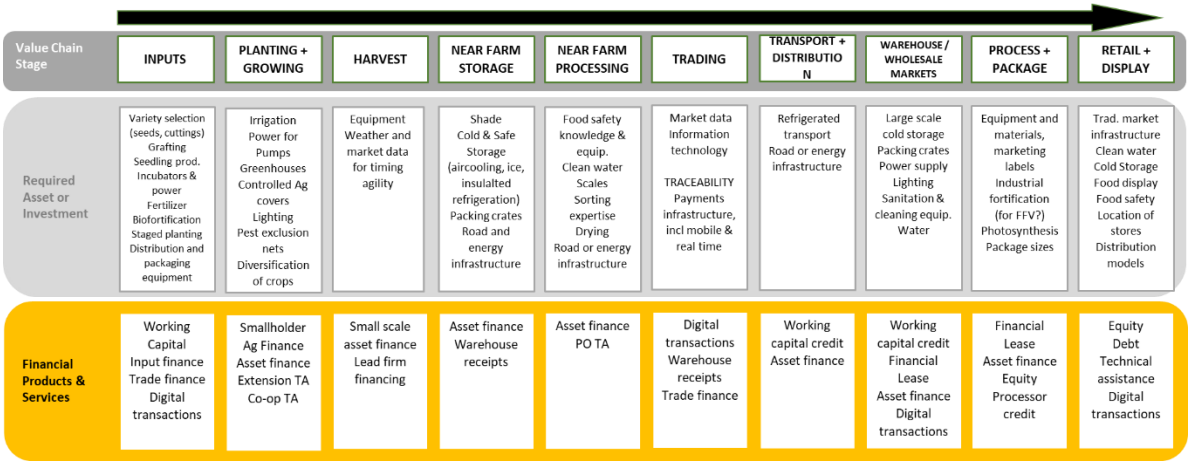
Adapted from (Varangis et al., 2012), (Moyes & Prasetya, 2017) and (C. Miller, 2012)

Unsecured credit	
Digital and mobile transaction services	Facilitated payment services, increasingly provided to support real time, or shortened transaction times between geographically distant parties. Can be provided by mobile phone operators or finance companies, supported by a deposited balance with the intermediary. Supports collection of historical financial data.
Microfinance loans	Often provided to a group which when members co- guarantee the loan for each other. Borrowers must prove they have some kind of income generating business that will support repayment of the loan, and make regular – often fortnightly repayments. These loans are more appropriate for traders or wholesalers rather than farmers who must wait until harvest to realise income and make repayments.
Smallholder agricultural finance	May be small unsecured loans designed for the seasonal cycles of farmers where credit is given up front but not required to be repaid until the crop has grown, is harvested and sold.
Medium term credit and investment	
Working capital credit to	Mid-size, generally secured, loans for small and medium enterprises (SMEs) for working capital or asset purchases assets (movable and real estate), cash flow

Table 1: Common financial products and services for agri-food enterprises *Adapted from (Varangis et al., 2012), (Moyes & Prasetya, 2017) and (C. Miller, 2012)*	
cooperatives or SME's	management services, and insurance. May be short or medium term. Expectation of historical records and some form of collateral to secure the debt are common.
Equity / Quasi equity investments	Investment in return for an ownership stake in the business or the option to convert in the future (eg. convertible shares or subordinated debt. Last in line for repayment if the business closes.
Loan guarantees	A promise by a third party (the guarantor) to assume the debt obligation of a borrower if that borrower defaults. Offered by public or private sources to increase lending to the agricultural sector. Often offered to larger enterprises. The guarantor may be liable for only a portion, or for all, of the debt.
Value chain trader credit – product financing	
Input supplier credit	In kind credit via the provision of physical inputs, with repayment at harvest. Cost of credit embedded in the price of the input. Way of marketing to farmers increasing sales; credit decision often highly relationship based.
Marketing company (or processor) credit	Upstream actor provides credit for agreed repayment with a commodity with a locked in purchase price
Lead firm financing	The driver of a value chain (eg. large retailer, exporter, processor or distributor) establishes an outgrower contract, and provides finance or a guaranteed purchase agreement that can be used to secure 3rd party credit. Often accompanied by technical assistance to improve quality standards.
Receivables financing	
Trade receivables	Mostly for working capital for large agri-businesses and import/export. Credit advanced against the security and credit assessment of accounts receivable or of confirmed orders. It's the creditworthiness of the downstream buyer of the goods, not the agri-business seller, that determines pricing, amount, etc.
Factoring	Sale of accounts receivable to another firm for a 'factor discount'. The buyer firm is responsible for all collections, accounts receivable bookkeeping, etc. Staged payments from the factorer to the seller, incl a final one when debt is actually collected. Not a loan, rather sale of an asset.
Physical Asset collateralization	
Warehouse Receipt	Farmers or other VC enterprises are issued a receipt from a certified, independently controlled warehouse that can be used as collateral for a loan from a third-party financial institution.
Asset finance	A loan to purchase a moveable asset, eg. small machinery or storage units, with a pledge over the equipment. May be provided by equipment vendors or banks, often with close collaboration between the two actors on credit assessments, seasonal repayment terms, and repossession and resale.
Financial Lease	A purchase on credit of machinery, vehicles, and other more expensive equipment that is designed as a lease with an agreement for ownership transfer after full payment is made in instalments, with interest. The asset itself acts as collateral as the financier maintains ownership of goods until it is fully paid for.
Repurchase	More common for exchange traded soft commodities where a bank purchases a commodity at an agreed-upon price and the company agrees to repurchase that commodity, on a specified date, at an agreed-upon repurchase price plus accrued interest. The purchase price paid by the bank is the equivalent of the principal advanced under a commercial loan. It is easier to document and trade a repurchase agreement in some countries than to reliably secure loans with highly liquid assets like commodities.

At each stage of the FFV supply chain different investments are needed to upgrade business practices and equipment that will improve the volume and quality of produce delivered to the end consumer. Usually tailored financial products and services are needed to support the investment or change in practice. These are represented in Exhibit 8 which maps each stage of a perishable food supply chain to commonly accepted desirable investments and the financial service required to facilitate that operating enhancement. This analysis is focused on financial products to support investments by farmers and MSME supply chain actors rather than enabling investments such as road or telecommunication infrastructure that would be typically undertaken by governments, or large-scale developers.

Exhibit 8: Business Investments and financial products required along the FFV supply chain



Source: Author's own creation

Specialised fixed asset finance, leasing solutions trade finance solutions and small-medium enterprise business credit can support investments that increase or promote consistent supply and quality of FFV. Fixed assets, or 'agricultural capital stock' is an important indicator of improved productivity in the agricultural sector (FAO, 2012). This is especially true for perishable horticulture crops, where specialised equipment is required to grow, harvest, store and transport perishable produce. Qanti, et al find that amongst mango farmers in Java, access to a truck and irrigation of the crop increased the probability of selling into the modernising channel (Qanti, Reardon, & Iswariyadi, 2017). Investments on upgraded growing techniques (eg. protected / greenhouse systems, irrigation) can improve quality in harvest; sorting and storage equipment can reduce spoilage; traceability systems can promote chain governance and improved food safety (eg. sanitary and phytosanitary (SPS)

requirements) and enhanced packaging, distribution and retail (for example, at wet markets) can open up new markets, eg. by increasing access for underserved or poorer consumers. Many of these functions are carried out by 'middlemen', or mid-chain actors, such as seed & input suppliers, aggregators, transport operators, and processors. Both smaller and larger farmers can be included in transforming markets if they have access to social network capital, productive capital, access to irrigation and road links (Qanti et al., 2017). Amongst both small and medium scale mango farmers in Java farming intensification (use of growth hormones) is facilitated by participation in these modernising market channels and by use of outsourcing specialised services to contractors ('sprayer-traders[*]') (Qanti et al., 2017).

Tailored finance can enhance the market participation and efficient trading relationships of these middlemen and service providers as they shepherd produce from the farm to consumers. SME trade finance must include products that accommodate the significant risks taken on by these crucial mid-chain actors. Risk arise as they purchase small consignments from many small growers, often paying on the spot with cash, locate a market and transport that produce in their own vehicles only to become price takers for their aggregated produce upon arrival at the wholesale wetmarket (Varangis et al., 2012).

3. Data: Supply and Demand of Finance to the Agri-food Sector and SMEs

Impact investors can play a particularly valuable role in enhancing the supply of finance to the agriculture and food sectors. Using published data on the supply of finance this section examines the current priorities, gaps and opportunities in the agri-finance landscape across developing countries. Drawing on the practices of prominent agri-food impact investors, the dominant commodities, sectors, geographies and non-financial outcomes are presented. We find that key opportunities for development outcomes are being overlooked.

Impact investment can play a vital role in 'crowding in' private sector funding to meet investment gaps and achieve development outcomes. Much has been made of the huge funding gap required to

[*] *The Sprayer Trader (ST) provides an 'outsourced' set of services to the farmer, consisting of land preparation, pruning, spraying, harvesting, and even marketing the mangoes. For ST services, there is no up-front or back-end fee paid by the farmer to the ST. Rather, the ST is contracted by the farmer and does the agronomic work and harvests and then the mangoes are sold. There is some revenue-splitting arrangement specified in the verbal contract. Usually (in 98% of the cases) the ST buys the inputs for the farmer and then subtracts those fronted expenditures from the final gross revenue; thus, the ST acts as a de facto creditor as well.* (Qanti, Reardon, & Iswariyadi, 2017).

achieve the SDGs by 2030. The UN estimates that investment of USD $5-7 trillion is needed per year, with a gap for developing countries alone of $2.5 trillion (UNCTAD, 2014), and states that this volume is impossible without the participation of the private sector. Very recently, the private sector has begun to analyse the role of and potential for business in implementing the SDG goals. Business opportunities by 2030 have been calculated to be worth more than USD$12 trillion annually for the private sector in four industry systems - food and agriculture; cities; energy and materials; and health and well-being (Business & Sustainable Development Commission & Alpha Beta, 2017). This would require USD$4 trillion in investment per year, and represent 10 percent of forecasted global output for that year (ibid). For SDGs related only to food, health, nutrition, poverty, sustainable food production, and agricultural productivity, the business opportunities are estimated to be worth $2.3 trillion, and offer potential to deliver 80 million jobs, 90% of which would be in developing countries (Business and Sustainable Development Commission & Convergence, 2017). These estimates are at aggregate levels across all actors and business forms, and require funding to flow through the finance supply chain.

The practice of seeking multiple non-financial returns means that impact investors specifically focused on horticultural crops & food systems have an opportunity to bring the nutrition and agricultural sectors together in a way that has not been demonstrated at scale to date. Many impact investors practiced in blending capital from multiple actors have experience using their convening power to align multi-sector and multi-party goals, in trialling new structures to grow wholesale funds, and in embedding social and financial outcomes into investment decisions. At the other end of the finance supply chain, impact investors can underwrite the development of new agricultural finance products (eg. warehouse credit) or provide the 'frontier capital' for emerging market entrepreneurs serving the low-middle income bracket. Incorporating private sector participants in a blended capital structure can provide investee enterprises access to additional benefits beyond funding, through exposure to innovation, business linkages, quality control processes, rigorous focus on long term financial sustainability and professional management of the day-to-day operations (Rankin et al., 2016).

3.1. Scope and Scale of Financial Services for Agri-food Enterprises

Agricultural credit markets are understood to be chronically underserved by private sector capital and formal financial institutions (FAO, 2012). Many factors contribute to banks preferring other sectors (low profitability, low education, high costs of service delivery), but it is the high degree of

uncontrolled production and price risk that is the most commonly cited factor (Wenner & IFPRI, 2010). Exacerbating the challenge, in developing countries farmers and agri-businesses often lack access to traditional forms of risk management such as guarantee funds, insurance, futures contracts or post-event government assistance (ibid). Exchange traded commodity markets, founded on globally available price and volume data, exist for very few agricultural commodities. Apart from oils and grains, only five food products are included as tradable soft commodity products around the world (Frozen orange juice; Potatoes; cocoa, soybean; and sugar from ("List of commodities exchanges," 2018). Except for the potato, all fruits and vegetables are excluded. These exchange markets and the widely available associated market data facilitate risk management instruments such as futures and derivative contracts.

According to the World Bank, global capital flows & FDI into food and agriculture are a relatively small proportion of total global FDI flows. The FAO reports a 2008 estimate of only 6% of USD $922 billion directed to agriculture, forestry, food and beverage sectors, with most of that invested into the latter 2 sectors (FAO, 2012). The 2014 level of private sector contribution to SDGs on food security was estimated at USD $200 billion, and with this SDG sector considered one of three natural candidates for greater private sector participation if appropriate risk return models can be developed (UNCTAD, 2014). Overwhelmingly, the largest source of investment in agriculture in low- and middle income countries are farmers themselves, rather than government, donors, or foreign investors (FAO, 2012. As public investment is low, improving the investment climate, including supply of wholesale finance, is critical to support farmers and food chain enterprises to invest in their own fixed assets (capital stock) (FAO, 2012). Disaggregation of the supply-demand gap for finance in developing country agri-food sectors is patchy (ibid). Some insights can be gained from studies that attempt to estimate aggregated demand from two overlapping sectors: agricultural producers and developing country SMEs. These are discussed below.

We know that whilst the current supply of finance into smallholder agriculture globally is estimated at USD $56 billion per year, demand from the 270 million smallholder farmers in Latin America, sub-Saharan Africa, and South and Southeast Asia is estimated to be four times greater at $200 billion (ISF, 2016). This gap does not consider the financial needs of SMEs operating downstream in the supply chain which offtake, process, transport and retail agricultural products. Very little data on the demand from and supply of finance to SMEs operating in food supply chains is available as bank lending tends to be grouped under 'trading', a category that includes many sectors. The IFC's Enterprise Finance Gap database reports that the gap in credit financing for formal micro, small and

medium enterprises (MSMEs) in developing countries across all sectors is USD 5.2 trillion (International Finance Corporation, 2017). Unmet demand from informal enterprises of is estimated at an additional USD $2.9 trillion. This under-served demand for credit finance emanates from 40% of all MSME's, or 65 million enterprises across the developing world (ibid), many of which operate in food and agriculture supply chains.

Agri-food enterprises experience barriers to finance from two converging factors – they operate in highly risky agricultural sectors and also experience the global supply shortage of SME finance. The requirement for collateral on debt can be a barrier for many SMEs to successfully be approved for a loan. Blue Orchard Finance find that amongst financial institutions lending to SMEs across four different regions (Caucasus, East Asia, Sub-Saharan Africa, and Central and South America), credit is the main source of financing for SMEs and usually is backed by collateral (Sherk & Zappia, 2017). Additional factors constricting the global supply of formal finance into SMEs include the tougher economies of scale with small deal sizes, higher costs and specialised expertise required to assess credit applications, and longer times to collect and verify financial information and credit application data (International Finance Corporation, 2010). In the broader environment, weak financial infrastructure (accounting and auditing standards, credit registries and bureaus), and inappropriate collateral and insolvency regimes contribute (International Finance Corporation, 2010). For financial institutions, higher capital adequacy requirements for perceived 'risker' segments can lead to lower profitability as leverage rates of lenders must necessarily be lower (Asian Development Bank, 2015). All of these additional costs contribute to higher risk premiums incorporated in the price of credit and in an operational sense hamper lending to SMEs, even in the formal sector. These factors also deter many SME's from seeking formal loans, acting to dampen demand as well as constrict supply. Commonly cited features of SMEs that struggle to access capital include the maturity of the enterprise and how innovative its model is ("Market Snapshot - The Impact Investment Market in South and Southeast Asia," 2017). Agri-SME lenders face additional barriers arising from the unique characteristics of seasonal agricultural production – uncertain liquidity, lack of crop diversification, low population densities, poor infrastructure and distance (Varangis et al., 2012). In addition, SMEs serving low-middle income populations are often pioneering untested models and thus carry a higher level of risk, as opposed to replicating and adapting business models de-risked and proven elsewhere (Bannick, Goldman, & Kubzansky, 2015).

Hence the gap includes not only a quantity mismatch, or supply – demand gap, but also quality or 'design' aspects – that is, financial products (eg. trade credit or asset finance) with appropriate

features and price for the needs of different sized food and agri businesses. Demand for financial services from food and agribusiness exposed families covers both short and long term agricultural finance needs, as well as off-farm finance often so crucial for poorer households managing education, family emergencies or celebrations and health expenditures from day to day. Short term finance refers to working capital for inputs; long term capital would cover larger 'one-time' expenditures on, for example, irrigation equipment or tree renovation. Significant gaps in supply and demand exist for short, long-term and non-agri finance needs in developing country geographies (ISF, 2016). Section 3.3 examines the barriers to increased supply of finance to the fresh fruit and vegetable supply chains by impact investors, with insights gathered from interviews and published reports.

Increasingly, recognition of the role of tailored value chain finance to strengthen mutually beneficial, stable and sustainable relationships between actors along food supply chains is refocusing attention on local agri-SMEs engaged in selling to and purchasing from producers. These agro-enterprises have been identified as key actors to increase effective supply of finance to producers at the end of the chain by bringing core competencies that financial institutions seeking to lend to farmers may not possess (Varangis et al., 2012). By acting as aggregation points, agri-food enterprises can leverage existing relationships and trading history with producers for origination and credit assessments, or utilse existing delivery channels or collection points for loan issue and repayments, or in-kind distribution of services and inputs (Initiative for Smallholder Finance (ISF), 2015). However the potential for agri-SMEs to play this role is severely hampered by their own sector's enormous supply gap of finance.

The ISF study on smallholder finance does not disaggregate of the supply-demand gap for different commodities, but does distinguish between loose and tight value chains. Tight value chains capture the flow of produce into a single channel, generally due to the qualities of a particular commodity, and involve greater control of the flow of goods and funding to ensure repayment via delivery of the crop and limit side selling (Varangis et al., 2012). Tight value chains are more likely to be integrated into global markets, with large offtakers and international buyers sourcing non-perishable crops from farmer organisations aggregating thousands of individual farmers. Supply chains serving domestic markets with fruits and vegetables are more likely to display loose connections, though smallholder famers may be more commercial than subsistence (ibid). Estimated, and largely unmet, demand for finance across all three credit categories – short, long term and non-agri finance needs is estimated to be USD $105 billion (ISF, 2016).

Of the USD $56 billion per year currently supplied, 30%, or $17 billion, is through value chain actors as opposed to direct from financial institutions or community banks. This value chain finance may provided by suppliers providing seed or fertilizer inputs on credit, or perhaps from multinational buyers entering into purchase agreements for crop harvests with commercial smallholder producers (ISF, 2016). Very little of the total supply of financial services (estimated at only USD $1 billion) is provided by commercial banks, and this is mostly directed to smallholders in tight value chains backed by an arrangement with an input provider or a buyer who on-lends to farmers, or backed by warehouse receipts (ibid). Farmer organisations able to negotiate contracts with buyers tend to be aggregating export crops such as coffee, cocoa, sugar or nuts (Initiative for Smallholder Finance, 2013). Factors impacting a bank's capacity and willingness to lend to smallholder farmers directly are similar to the agri-SME challenge, and include 'supply-side' barriers such as lack of technical expertise in designing loan products for particular crops, lack of staff skills for agricultural sector credit assessments and a weak case for investment in upfront back-office technology and processes to serve the segments (ibid).

Some 'high touch NGOs' (eg. One Acre Fund) do serve producers growing local staple cereals such as maize in East Africa or rice in Asia, coordinating programs to strengthen and tighten those supply chains. The ISF estimates that only 10% of smallholder farmers (ie. with less than 2ha of land) are integrated into export supply chains, with an only slightly higher figure of 15% in South and Southeast Asia (ISF, 2016). Again, actors in horticultural agricultural supply chains serving domestic markets are far less likely to be operating in tight supply chains and hence qualify as an investor target market. Unfortunately very few pilots or established models are observed for financial products most in demand by these commercial farmers in loose supply chains (those most likely to be growing fruits and vegetables) (ibid). These financial products include long term finance for purchasing assets or upgrading plant stock, post-harvest trade finance to access markets, insurance for agricultural enterprise risk and payment and transaction services (ISF, 2016). All of these products are particularly important for high value high input horticultural crops.

3.2. Where is Agri-food Impact Investment Directed, and Which Outcomes are Prioritised?

So are impact investors seizing the unique opportunity as innovators in financial services to strengthen horticultural supply chains and to promote nutrition outcomes? On the financial services supply side, we can examine the portfolios of self-identified agri-focused impact investors in the Council for Smallholder Agricultural Finance (CSAF) to understand in which geographies, crops,

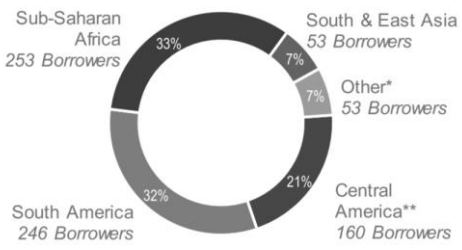
and impact sectors receive most investment. CSAF members report that in 2017 they collectively provided $716 million in loans to 794 SME businesses across 63 countries (Council on Smallholder Agricultural Finance (CSAF), 2018).

These development focused agri-business investors and agri-finance lenders have developed specific expertise to strategically focus on the agricultural SME sector. The 12 members of CSAF define themselves as a pre-competitive body of financial institutions working to facilitate market entry and increase lending to agricultural businesses in the missing middle (CSAF, 2017). The missing middle encompasses cooperatives, associations, traders, processors, and exporters which act as critical intermediaries, aggregating smallholder farmers within increasingly complex global food and agricultural supply chains in developing countries (Council on Smallholder Agricultural Finance (CSAF), 2017a). In reference to the finance supply chain, these organisations are either providers of wholesale finance to local financial institutions (MFIs or commercial banks offering rural and SME finance) or direct finance to medium agri-businesses including farmer organisations or cooperatives. A small number also lend to importers and international traders.

This group of investors publish a report on their lending activities each year, allowing an analysis their portfolios in developing country agri-finance markets. The group reaches 2.3m farmers through the finance of 765 businesses across 65 countries (ibid). In 2016 they disbursed USD $682m to businesses generating combined revenue of USD $7.6 billion. This lending portfolio is large, but relatively insignificant in given the estimate of USD $200 billion in total smallholder demand for finance discussed above.

The distribution of CSAF members' lending by geography and investee size, depicted in Exhibit 9 and Exhibit 10, indicate concentrations in Africa and Latin America.

Exhibit 9: Percent of Borrowers by Region
Exhibit 10: Percent of Loans by Borrower Revenue



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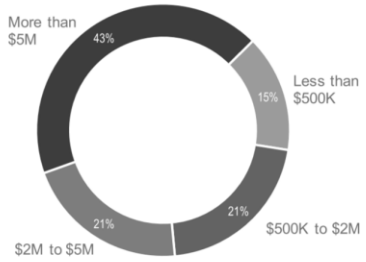
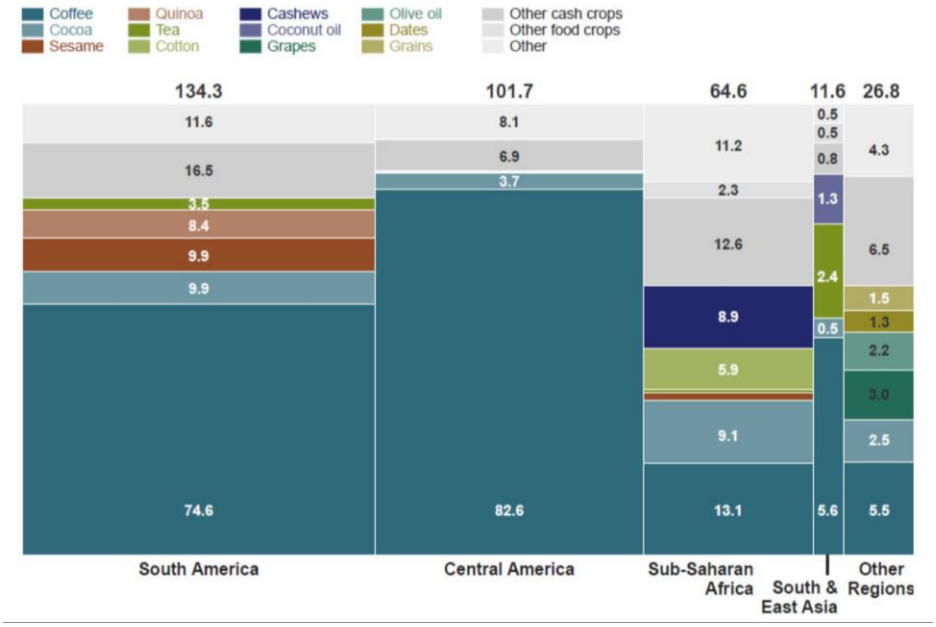


10.

Source: CSAF State of the Sector Report 2017

Analysis of commodity exposures reveal the bulk of 2016 lending is to businesses in the coffee 39%, cocoa 12%, and ground and tree nut 12% crop supply chains. Fruits and vegetables (mostly mango, pineapple and beans) rank 7th in 2016 new lending volume (ie. disbursements) after quinoa, soybean and rice (Council on Smallholder Agricultural Finance (CSAF), 2017a). These exposures show a trend toward slightly greater diversification of crops since 2013, though the concentration in export commodities remains. Exhibit 11 shows crop concentrations of CSAF members for their 2013 lending activities. Some CSAF lenders work under specific mandates requiring investments only into export crops (lending to those enterprises with export contracts as a risk mitigation tool).

Exhibit 11: Agricultural Social Lending Landscape: Disbursement in USD millions, 2013



Source: (Council for Smallholder Agricultural Finance (CSAF), 2014)

The three most common financial products deployed by CSAF members to improve supply of impact finance to agri-businesses are direct debt into enterprises (incl. producer orgs), and equity or debt to local lenders providing agri-finance, ie. rural banks or local financial institutions. Provision of guarantees, or development of transaction services are not common strategies amongst this group. Most CSAF members' agri-business funds are producer focused, though some of the larger entities also manage separate funds targeting SMEs, though not sector specific.

An analysis of individual CSAF member exposures by commodity reveals that only one investor has allocated more than 20% of their agri-focused portfolio to fruit or vegetable crop supply chains. This excludes seeds and nuts, and includes dried fruits or simple processed fruit pulps and honey.

For all other members the figure is rarely above 4% of their total portfolio (based on analysis of publicly reported data compiled for this research).

The Rural and Agricultural Finance Learning Lab collates a data set on 785 agri-finance programs across the globe. The latest detailed data reveals that specialty financial products (credit, savings, payments services, leases, working capital, asset finance, warehouse receipts, insurance) designed for horticultural growers are offered by financial service providers representing only 16% of total smallholder farmers served. (based on analysis of a dataset provided by the RAF Learning Lab for this research).

3.3. The Investor's View on Domestic Markets, Crop Selection and Nutrition (Interviews)

"There are obvious and compelling impact benefits to financing domestic value chains at the smallholder level and local food security and nutrition level."

To better understand the reasons why so little impact investment is directed to FFV supply chains primary research using semi-structured qualitative interviews were conducted with CSAF members. Interviews sought to fill information gaps on if and how nutrition and food security fit into these impact investors' social impact goals, examining fund mandates, impact externalities, and their perceived role in influencing the food system. A number of agriculture and nutrition NGOs and a DFIs were consulted to further explore these issues. Whilst the role of agricultural production and effective food supply chains are increasingly acknowledged as pathways for food security and nutrition, nutrition outcomes at both individual and food system levels are not often observed in the social and human wellbeing priorities of impact investors. Discussions focused on selection of commodity value chains and perspectives on fresh food and vegetable markets, the role of crop diversity in portfolio construction, nutrition outcomes as a social impact priority, and impact investment's role in strengthening domestic orientated value chains. An example interview guide is included in Appendix c) along with a list of interviewees in Appendix a). Themes emerging from the interviews are discussed below.

Preferred supply chains

Interviews with CSAF investors gave some insight into the dominance of coffee, cocoa and maize amongst agri-finance impact portfolios. The rationale for selecting particular crops or commodity

supply chains seems to be dominated by limiting downside financial losses through risk management strategies, rather than looking to the upside return potential of new markets or high value crops.

As is observed from portfolio allocations, investment is directed towards export oriented crops and supply chains. Export orientated value chains are perceived to be more integrated, have fewer downstream actors who are more sophisticated, comprise known buyers and operate with formal contracts. These tighter chains improve investor confidence by providing greater market visibility – ie. information on volumes and quality of exported produce, greater predictability of demand and enforceability of agreements. Conversely, domestic markets are perceived to be quite fragmented and weak, and enterprises in these supply chains consequently receive much smaller, if any, allocation.

Restricting investment activity to crops destined for particular export markets can make it easier for a lender to secure appropriate collateral. The presence of an offtaker, often a large buyer that provides an export contract as collateral for short term debt, is a significant and often necessary feature for lenders of working capital. Some CSAF investors highlighted that they can only lend in hard currency and hence a buyer's USD or EUR export contract provides the borrower access to that currency for repayment of debt. Security in hard currency negates the need for lenders to hedge exotic currency risk with futures or FX hedges. Other forms of collateral such as pledges over fixed assets or guarantees can be less straightforward to arrange.

Some CSAF investors cited social impact focused reasons for selecting particular supply chains, including consideration of those with a relatively large number of smallholder farmers supplying into the chain, thereby maximising the potential scale of social impact. Another considered crops where it is possible to secure strong premiums for quality and where intensive smallholder manual labour contributes to that quality such as cocoa, coffee and honey.

Some of the larger CSAF investors have recently started to prioritise products based on the size of market demand and the expected growth of that market, based on publicly available projections (eg. from the FAO, and OECD). For example, growing demand is observed for simply processed, value-added products such as dried and canned fruits.

Supply chain segment orientation

Discussions on preferred segments of supply chains confirmed that impact investment strategies for agriculture remain focused on upstream enterprises. CSAF investors focus on businesses that

capture value from production, aggregation and early stage processing, rather than on operations that focus on retaining quality or reducing loss in mid-chain or downstream agri-food enterprises. The value chain segments receiving impact-focused agri-finance are input dealers, farmers, producer organizations, near farm storage, aggregators, and early stage processors. Some arrangements include formal value chain finance structures with buyers receiving credit to pre-fund inputs for producers, as described in section 2.3 Value Chain and Agri Finance structures above. No CSAF members reported investing any significant proportion in seeds or seedling production, transport and distribution, late stage processing, packaging and marketing, or retail of produce.

Mirroring challenges in SME lending around the world (per section 3.1), CSAF members acknowledged that lending to mid-chain mid-sized enterprises, for equipment, fixed assets or working capital requires different internal capacity and a different scale of loans. Additionally, the large investor ResponsAbility highlights the challenge of missing, unreliable data in its 2018 market analysis:

"The data gap is an acknowledged reason for the perception that MSME markets and investments have a less favourable risk/return profile than traditional markets." (Hailey, 2017).

Some larger CSAF members acknowledge the benefit of including downstream food and beverage sectors to rebalance risk in a portfolio – with potentially fewer environmental, social and sustainability issues in operations. Larger investors with greater potential for portfolio diversity, can look more broadly at food system investments, for example in animal protein or downstream packaged goods, which tend to demonstrate less volatility in sale prices and risk in food safety obligations.

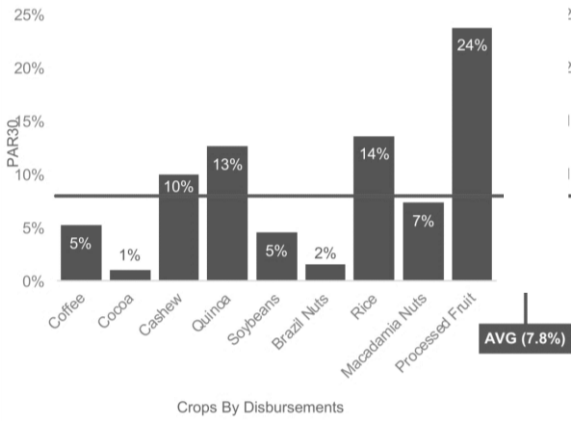
Perceptions of Fresh Fruit and Vegetable Supply Chains

The strong message from most CSAF investors is that fresh fruit and vegetable production practices, market dynamics, and business models are inherently different to currently prioritised supply chains. These differences create barriers to portfolio diversification as each market requires expertise to understand a borrower's supply chain relationships and creditworthiness. Each business model and supply chain requires effort to build out due diligence assessment criteria. In particular, significant differences cited include:

- Growing practices vary widely within horticulture; inputs, fixed assets (eg. shade, irrigation or crating), and harvest times can be very specific to particular crops
- Timing of cash flows varies greatly depending on the crop, the business model and geographical distribution of producers and buyers
- Scale is often small and sales can be irregular
- Growers of perishables may sell into a diversity of channels to maximise revenue from different quality produce, for example processing for poorer quality tomatoes. This means it is difficult to source reliable sales data or secure sales contracts for collateral from single, right-sized buyers.

Some CSAF investors claimed a scant pipeline of investees, and that there are few financially stable businesses with demonstrated track record in FFV. A number reported high write offs of loans in the past, or pointed to reported very high Portfolio at Risk levels in horticulture and fruit and vegetable business lending. The 2017 aggregated report of CSAF member portfolios reported PAR30* of 24% in loans to the processed fruits sector, as can be seen Exhibit 12Exhibit 12. This rate is considered exceptionally high, more than 3 times the average across all sectors and crops.

Exhibit 12: CSAF 2017 Portfolio at Risk (PAR)30[†] for Most Financed Crops



Source: (Council on Smallholder Agricultural Finance (CSAF), 2017a)

[†] *PAR30 is a measure of the health of a credit portfolio, calculated by dividing total debt by outstanding loans with at least one overdue repayment >30 days.*

Other barriers cited include the difficulty of verifying sustainable practices in horticulture, with fewer third party resources available to rely upon, a factor critical to investors focused on environmental impact through sustainable agriculture.

Only one investor noted upside potential from the growing global demand for FFV, identifying some fruit supply chains as a key market in all regions in which it operates. This investor expected to invest in mid-chain enterprises – trading and simple processing of these crops rather than upstream production - due to lower risk in dried products, canned fruits, juices and healthy bars.

Social Impact Priorities

Investments in financial inclusion and SME finance in agriculture and food systems can contribute to achievement of many development outcomes and SDGs – those on climate change, sustainable agriculture, agricultural livelihoods, fair trade, workers rights, and inclusive and slavery free supply chains. Impact investors with limited resources for monitoring and evaluation must identify which of these social outcomes will be measured and tracked. Once prioritiy social outcomes are defined, indicators will be built into systems for strategic, pre-investment and management decision making. CASF members have recently adopted a suite of Environmental, Social and Corporate Governance (ESG) lending principles, with one of three principles 'financing borrowers that demonstrate positive ESG practices'. CSAF members have agreed on six practices that demonstrate this commitment, including "increasing the availability of affordable, nutritious foods for local consumers" (Council on Smallholder Agricultural Finance (CSAF), 2017b). However discussions revealed that CSAF members do not yet link the contribution of the crop being financed to the availability, reliability, quality, calorie or micronutrient composition of the food system, and certainly have not operationalised measurement or monitoring of this contribution.

In interviews and reviews of portfolio data, impact outcomes are targeted to 'beneficiary' producers or employees, not consumers of food. The 2016 CSAF annual report highlights that businesses served by members paid over USD $6 billion to smallholders for their crops in 2016, and employed over 75,000 men and women (Council on Smallholder Agricultural Finance (CSAF), 2017a). Universally, nutrition and food security outcomes are not regularly measured as priority impact goals by the interviewed impact investors, either at the household level or the food system level. Contributions by these CSAF investors to food security are founded primarily on the income pathway - rural employment in agri-food business and livelihood stabilisation for producers, as

opposed to increases in availability or utilisation of diverse foods. Most agricultural investors choose to focus their measurement, monitoring and reporting of social impact on producer households' financial inclusion rates, income and agricultural productivity, accepting theory of change evidence that improvements in these can result in positive outcomes on human health, education levels, and environmental sustainability. Whilst these are difficult to measure in the short term with benefits accruing over time, there is work being done to identify leading indicators of these outcomes as discussed in Section 2.1.

Farmer household, producer organisation and employee income are the most commonly reported impact measures employed by CSAF members. Other common key outcome data points include 1)

Who is being served (eg. No. of partners, No. of farmers or employees, gender ratios, No. of people trained to help assess lives impacted, No. of people employed by financed businesses), and 2) Production results (eg. producer organisation production and sales volumes, hectares under cultivation, certification rates. Some monitor environmental features like sustainable agronomic practices, electricity use and water management in processing, and impacts on buffer zones).

Across a target community, an investor will generally consider rates of poverty, education, financial inclusion, and smallholder market integration as pre-investment decision inputs, and may track change over time every few years. At least one member indicated that the organisation conducts deeper dive post-investment impact studies on around 10% of loans which may look at nutrition outcomes. In a due diligence assessments, a nutrition outcome may be reported as a bonus (and an exception). For example noting that an investees's product is nutrient fortified during simple processing, or the projected number and profile of consumers of a product.

At what level is impact sought?

Whilst many interviewees stated that they seek sectoral, domestic and international systemic impact from their investment activities, monitoring of industry and market outcomes at these macro levels is not a focus of impact measurement. Rather, impact measurement and monitoring focuses on two levels: the individual household of a producer or employee, and the enterprise or producer organisation productivity. A number of CSAF investors alluded to the strategic tension in crop and value chain selection between choosing crops that will generate demonstrable impacts for the target beneficiary households, and choosing value chains that benefit the entire food system and potentially remote consumers. It is harder to prove causality from producer or value chain financing activity

that may have systemic effects, making it difficult for impact investors expected to demonstrate impact to their own suppliers of capital.

Perspectives on their activities' contribution to nutrition and food security

"There is enough evidence that says increased income helps with nutrition."

Most CSAF respondents said food security levels may be reviewed at due diligence to help with targeting and understanding the circumstances of farmers. But as a 'cross cutting issue', food security results do not drive decisions, and the nutritional contribution of a crop was never cited as a reason to select a particular supply chain investment. To illustrate, one funder hypothesised that available funding for agri-finance investors is from profit seekers who do not specifically target nutrition outcomes, giving greater importance to farmer inclusion outcomes. This obviously drives investor activity and selection.

Nutrition outcomes are generally perceived as the domain of human health programs focused on individuals and households. Nutrition is often seen as a first 1,000 days of life challenge, with a focus on maternal and child nutrition issues. In addition, household nutrition is not monitored or measured as an input into investment decisions as it is considered very difficult to attribute a household's health outcomes (producer or consumer) to any one supply chain investment or producer finance program.

For CSAF investors, increased production & reduced production losses in early-stage processing are satisfactory outcomes alone. Extending effort to measure increased calories, or micronutrient diversity is not a priority as these are not typically defined outcomes of supply chain finance programs.

Discussions confirmed that demand for finance from smallholder producers of staple crops is so high that the volume of demand crowds out investments that target different crops including fruit and vegetables. It appears that the CSAF Impact investors can generate sufficient positive social impact outcomes by focusing on staple cereal value chains. It is believed it is possible to support livelihoods, promote smallholder agricultural value chain integration & poverty alleviation without departing from less risky (commodity) markets.

Several NGOs and others working to integrate nutrition into their value chain work, have up until very recently focused work on the household food demand side, ie. individual consumption choices. Thinking through how to tackle loss of nutrients along the supply chain through maintained quality and reduced food loss is very recent. In addition, some respondents observed that changing practices along a value chain, for example by improving storage or faster distribution, is difficult to promote because there is no demand from consumers, especially rural & remote areas.

Perspectives on domestic market potential

> *It should also be noted that in 2016 Alterfin strengthened its partnerships with organisations whose agricultural output is intended for the local market. Food sovereignty is a challenge for many countries in the South, which is why supporting domestic production capacities that supply local distribution channels makes sense.*
> Alterfin Annual Report 2016, pg24

Despite these statements, there is a clear perception that the downside risks in materially extending into domestic market focused supply chains override the positive financial or social impact potential. Again, a number voiced concern about investor capacity to sufficiently develop in-house expertise on the multitude of supply chain arrangements and business models.

Reasons cited to avoid domestic market focused supply chains were largely focused on risks in informal supply chains, mirroring the challenges cited for FFV markets. Any positive rationale for extending activity into domestic markets focused on the social impact potential rather than business potential. Commonly cited perceptions of domestic consumer oriented crop supply chains include:

- Diversity of production methods, markets and the small scale of output
- Disaggregated demand from multiple distribution channels, with much output traded informally and through wet markets. These less stable sales channels make it very hard to assess and measure business potential with reliable data.
- Weak or no formal forward sales contracts or offtake agreements that could be used for collateral by borrowers
- Investee enterprises display weaker management capability, possibly because enterprises haven't been vetted by international buyers requiring that they meet certain standards, are audited each year by certifiers, etc
- There is low demand for finance at a suitable scale from domestic focused farmers / agribusiness

A significant due diligence factor for foreign lenders is currency risk; export sales provide enterprises access to hard currency (USD, EUR), which they can use to repay foreign lenders. In some markets there are also policy or regulatory constraints on foreign direct investment or on pricing of foreign debt, adding complexity and cost to a transaction.

It seems that the buyer or ultimate consumer of a product is not a key factor considered pre-investment – rather, it's the structure of the market and the visibility, scale and integration of the particular supply chain that influences risk and return judgements and investment selection. As respondents reflected, the fact that many investments were into international supply chains was a consequence of the formal supply chain structure and availability of trade order contracts for collateral, rather than a specific philosophy or strategy to select particular crops.

Some CSAF investors went further and mentioned more pragmatic internal capacity constraints:

- Investments in domestic food systems need local intelligence and relationships, a strong local presence, often a local legal entity, and dedicated local staff. To manage a geographically spread portfolio would require duplicating this capacity in multiple countries.
- Different financial instruments are needed for local lending, into local supply chains. Most current funds are not designed for delivery of these instruments – investment principles around scale, currencies and collateral and product design are defined for export crops.
- Some investors are constrained by their mandates to invest in Fair Trade certified goods, citing this as a reason to continue portfolio allocations to export crops.

Only one interviewee suggested a potential financial benefit to investing more into domestic focused supply chains. Domestic demand from a growing consumer class can be a complement to low prices and export revenue for large food processers, and hence a risk mitigant. Another noted the importance of segregating domestic demand between rural and urban markets, noting that urban markets must be the focus for professionalising a supply chain because of food safety requirements, and greater demand for standardised products.

Other benefits were social impact rather than financial return oriented, with local food sovereignty, food security and nutrition benefits mentioned briefly. It seems the perception of risk remains too large for most of the CSAF cohort of agri-business impact investors.

Crop Diversity

Adding diversity to an investment portfolio is an acknowledged strategy to mitigate against concertation risk from price fluctuations or disease. Diversity of calorie sources and micronutrients is also crucial within food systems and individual diets. It seems that diversification alone is not considered a sufficient driver for extending investment beyond export and cereal crops into horticulture.

CSAF investors reported a tension between diversity of selected crops in portfolios, and maintaining sufficient expertise, process efficiency, and product design across supply chains. Many stated that they could secure sufficient investment portfolio diversity through geographic presence, and within the range of existing export crops. Most have concentrations in coffee, through for some the proportion has dropped in recent years to under 20%. Pragmatically, coffee offers less risk and sufficient impact results, lessening the impetus to diversify into different crops. For some of the larger CSAF investors the 'food and agriculture sector', covering animal source foods (milk, eggs, meat), livestock and fibre products (wool), offers sufficient diversity without needing to look at different crops, and given their portfolio also includes other sectors like Financial Inclusion and Clean Energy.

Reducing dependence on a single cash crop is considered helpful for producers themselves to add different food sources or income streams to a copperative enterprise or farm household. Some lenders do see producer organization members growing a variety of food crops but they may not commercialise these products or market them mutually through the co-operative. Whilst lenders consider it beneficial to see a range of income sources for household resilience purposes, most lenders will not lend for alternate crops. CSAF members would prefer the producer organization and borrower to specialise in the main crop that they finance.

Overwhelmingly, nutritional and micronutrient diversity is not a consideration in portfolio construction, except in some cases where fortified grains may be preferenced. Only one interviewee made detailed crop portfolio exposures publicly available, and reporting growth in FFV over the past 3 years from 11% to 16% to 20%. This was attributed partly to chance: "We are on a growth path, so some investments are opportunistic".

Financial features of an investment

Important financial features of an investment decision relate to the policy and market environment, the investment itself, and the fit of a particular investment within the investors' portfolio. Each investor will have its own screens for strategic priorities, risk tolerance levels, and due diligence criteria, however there are some common concerns that are relevant to the hesitancy to extend investment into domestic targeted supply chains, agri-food SME and horticultural crops.

At the macro level, government policy alignment, market transparency / visibility (published prices), and demonstrated demand for the product are common considerations. Assessment of the operating environment will consider signals from the government on priority crops for that country's market development. A country's policy levers, agriculture spending and research priorities will direct attention to those crops. Many country's priorities remain directed towards staple foods to boost calories in the food system as discussed in Section B.

CSAF investors noted the importance of following market signals when assessing opportunity and risk, looking for demonstrated demand for whatever good or service an SME business is providing. A factor in building a new sector is to promote demand for products before trying to attract investment. All look for a familiar value chain structure – aggregators with buyer contracts that can be used as collateral, and track records of enterprise performance to support new products such as asset finance. One investor highlighted its strategic goal to try to shorten the supply chain, as this gives more control and greater visibility of transactions. This filter does not lend itself to losoe domestic crops supply chains.

Commonly cited features of an individual investment opportunity are suitable scale to minimise transaction costs (measured for example through minimum sales value of an enterprise), demonstrated track record of financial viability (or steady progress towards breakeven), confidence in management, and suitable collateral to secure debt (purchase orders / export contracts or fixed assets).

And investor capability to assess strategic alignment and fit within the risk profile of the portfolio requires internal familiarity with the business model. Lack of capacity to effectively conduct due diligence and credit assessments on many different business models results in screens against new crop supply chain actors. Smaller CSAF impact investors acknowledged less risk tolerance for unproven business models.

Takeaway Observations and responses

Perceptions of CSAF impact investors of the barriers to lending to FFV sectors combine several intersecting challenges inherent in disaggregated domestic supply chains: SME lending in emerging economies, lack of specialist expertise to assess multiple supply chain models and a hesitancy to seek and claim systemic over individual impact.

Some of the key assumptions that should be tested as the focus for investment shifts from farmer production to value addition in the mid-chain, include

- There is low demand for finance at a suitable scale from domestic farmers and upstream agribusiness.
- The small scale of production is a barrier. Aggregation models can address this.
- The main positive rationale for extending activity into domestic markets is the social impact potential rather than business potential
- There is greater potential at the top of the supply chain for impact on smallholders' livelihoods and nutrition. However prices and revenue are acknowledged as more volatile. With specialist expertise on domestic markets, it is possible for impact investors to reduce price/revenue risk by investing in more stable downstream segments (wholesale, retail) of the chain, though direct impact may be harder to measure.

Some of the valid barriers for which government and NGO support can be catalytic, or where models of innovation and technology are appearing elsewhere include

- Production volumes and demand data to assess creditworthiness is crucial and domestic oriented FFV supply chains present a perfect storm of opaqueness. Technology is allowing new business models using digital data collection, alternative datasets for credit scoring, online marketplaces and blockchain ecosystems to be deployed.
- As lenders, most CSAF members are seeking downside protection rather than upside potential in their debt portfolios. The lack of sales contracts to serve as collateral, and exchange rate risk can be supported with guarantee funds or price supports for currency hedging products.
- There is a hesitancy to make value judgements on 'better crops' that build the nutritional content of the food system. The nutrition community can advocate for improving supply at a systemic

level, and can support certification systems that validate the types of value added products that support the overall nutritional content of the food system.

3.4. Indonesian Agri-finance Supply

Indonesia's 58 million SMEs account for 99.9% of total enterprises in the country, contributed a massive 60% (and growing) to national GDP in 2014, and employed 97% of the total workforce (Asian Development Bank, 2015). Yet Indonesia's SMEs face similar challenges in accessing finance to their global counterparts. Data on agri-food SMEs are difficult to disaggregate from total SME activity, but the most recent 2011 government data ascribed just under half of all SMEs to the agriculture, forestry and fisheries sector, employing just over 40% of all workers. However only 20% of commercial lending goes to SMEs (ibid). Data on lending and credit to agri-food sectors is even harder to access (Moyes & Prasetya, 2017). The trade sector (which includes hotels and restaurants) receives just over half of formal commercial SME loans, with 15% to the services sector and 10% to manufacturing. Most credit is for working capital, with only 28% for investment purposes (Asian Development Bank, 2015).

We have seen that Indonesia is not currently a target market for agri-impact investors' wholesale capital or direct investments. Other sources of capital available to SMEs include microfinance institutions, finance companies (mostly providing secured receivables financing incl. leasing), venture capital companies and the state owned pawnshop, the Pegadaian (Asian Development Bank, 2015). Total amounts disbursed through these financiers is not available, but is thought to amount to around half of that provided through the commercial banking sector (ibid). The government of Indonesia sponsor several schemes to promote increased supply of credit to SMEs. Selected commercial bank and rural bank lenders are licenced to offer KUR (People's Business Loan) credit products with defined loan terms (including subsidised below market interest rates), and a guarantee from the state owned credit guarantee companies over 80% of the outstanding portfolio (70% for agriculture) (Asian Development Bank, 2015)(Microsave, 2016). The collateral free product has a maximum limit of IDR25m (USD$1,800), with the larger version, KUR Ritel, ranging from IDR20m-500m (USD 1,800-35,000) (Microsave, 2016). Terms are from 3-6 years for working capital or up to 10 years for investment capital (ibid), and designed for SMEs which are ineligible for commercial loans from a bank.

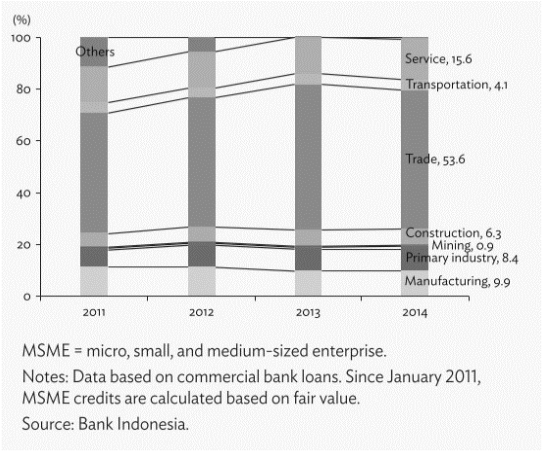
As of 2014 less than 12.7mil loans had been disbursed since it was introduced, with annual disbursements of 2-2.5mil loans, nowhere near meeting the demand for Indonesia's 60 million SMEs (Asian Development Bank, 2015). The government sets targets for disbursements, but the banking sector has released less than half each year. Loans to the 'trading and commercial sectors'

are 60%, loans to agriculture 16%, and over half receiving these loans are enterprises in Java (Moyes & Prasetya, 2017)

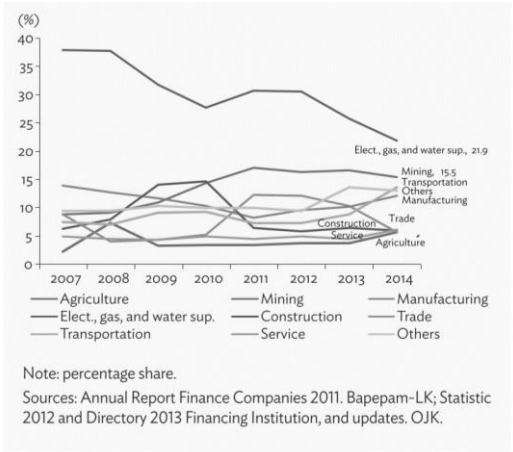
Agricultural Finance Landscape in Indonesia

Whilst half of Indonesia's SMEs are engaged in primary production (including forestry and fisheries), this sector accounts for only 8.4% of formal commercial SME credit according to the ADB's Asia SME Finance Monitor. Some estimate even lower figures of around 5-6% (Microsave, 2016). MSME loans and leasing by sector are as depicted in Exhibit 13Exhibit 13 and Exhibit 14 below. Agriculture has accounted for 6% of leasing contracts since 2007, though transportation's share has risen to 14% over the past 5 years (Asian Development Bank, 2015). Of all receivables backed financing in Indonesia in 2014 (leasing, consumer credit, factoring, or credit cards[‡]), factoring accounts for 2.6%, and of that, the agriculture sector makes up 1% (ibid). Challenges exacerbating the low rates of factoring include Indonesia's poor credit information systems, and in particular the secured transaction framework. These regulations prevent banks from obtaining a legally enforceable security interest in most movable property, including inventory, accounts receivable, and delivery contracts. Banks therefore prefer immobile property like land, often not available to farmers who don't hold the legal title to the land they use (Moyes & Prasetya, 2017).

Exhibit 13: Indonesia MSME Loans by Sector
Exhibit 14: Indonesia Leasing by Sector



13.



14.

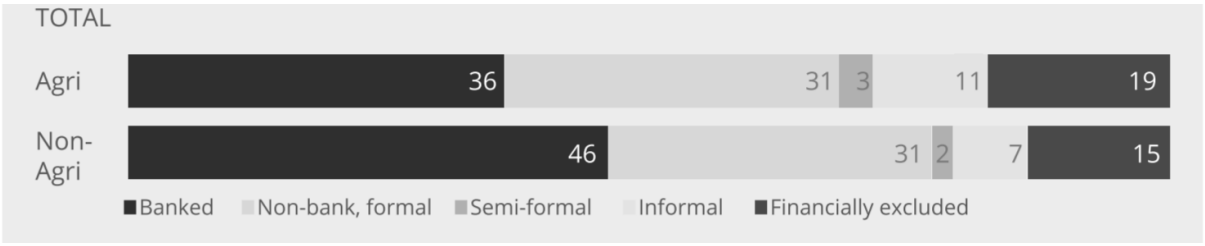
Source: Asia SME Finance Monitor 2014 (Asian Development Bank, 2015).

[‡] See Section 2.4 for definitions.

Analysis of the banking sector in Indonesia suggests that commercial banks have not targeted farmers and agri-businesses due to the specialised expertise required on crops, production and weather risks, lumpy cash flows, value chain functions, and remoteness of clients from branches (Moyes & Prasetya, 2017). Although agriculture and fisheries are amongst the four preferred sectors for the government's guaranteed KUR credit product, most banks favour MSMEs. This is partly due to the unsuitable product design for primary producers, with monthly repayments not matching farmer's seasonal cash flows, branches being based in urban areas, and a lack of expert capacity and staff to manage agricultural lending (Microsave, 2016). Liquidity squeezes inherent in seasonal production also affect the lender which may not be able to access longer term wholesale debt from further up the finance supply chain, making it difficult to offer seasonal credit products (ibid).

A 2011 Bank Indonesia survey found that only 4.9% of farmers had received loans from non-governmental sources (Moyes & Prasetya, 2017), however significant informal financing is likely going on between supply chain actors up and down the chain. A study of 20,000 adult individuals across four provinces found that those involved in agriculture are more likely to be financially excluded or more likely to rely only on informal financial services (30% v's 22%) (Oxford Policy Management, 2017). Commercial banks are not the only way to access credit for agri-businesses – other sources include regulated non-banking finance companies and larger mid-chain enterprises. Financing for the agricultural sector from finance companies is a similar proportion to that of formal banks at around 4-5%; leasing products and individual consumer finance, often for motorcycles, account for 98% of financing, and most is concentrated in the densely populated provinces of Java. It is not possible to disaggregate what proportion of clients operate in agri-food supply chains (Moyes & Prasetya, 2017). Often, agro-processors and food retailers fall into different categories of clients that banks use, such as "commercial," "manufacturing," or "retailing and service industries".

Exhibit 15: Financial Inclusion and Access in Indonesia - Agribusiness v's non-agribusiness (%)



	Banked	Formal, non-bank	Semi-formal	Informal	Financially excluded
Using financial products or services offered by...	Financial institutions that are recognised as banks	Non-bank financial institutions that are regulated / supervised by the financial services regulatory authority (OJK)	Non-bank financial institutions that are not regulated / supervised by the financial services regulatory authority (OJK)	(a) money-lenders, (b) village-based informal associations	Does not use financial services from any formal or semi-formal institution, nor through informal means
Examples of providers of financial services	Commercial banks BPDs BPRs	Multi-finance companies	Savings and credit cooperatives	Arisan	"I keep my extra cash/ savings at home."

Source: Understanding people's use of financial services in Indonesia: survey on financial inclusion and access (Oxford Policy Management, 2017)

There is little data on aggregate financing levels amongst supply chain actors. Informal value chain finance is difficult to quantify, requiring detailed, frequent surveying up and down the value chain (Moyes & Prasetya, 2017). Other forms of agricultural finance have not seen significant adoption. Indonesia introduced a warehousing system in 2008, but there has been very little take-up, with only 931 receipts issued to 2013 (Moyes & Prasetya, 2017). Issues with factoring were discussed above. The People Credit Program (KUR) loans are available, though banks are hesitant to dedicate too much of this portfolio to agriculture – in 2013 it is 16% of all KUR loans went to the agricultural sector (Moyes & Prasetya, 2017). It is likely the majority of crops financed by KUR are rice and corn, making up 61% and 19% of total area planted to food crops, respectively (ibid). Larger corporate and commercial agricultural customers of commercial banks are often palm oil growers (ibid). Credit bureaus and moveable asset registries have only recently begun to be established, making access to financial records more available for credit assessments (ibid). Research on value chain finance models in Eastern Indonesia highlight some pilots promoted by lead firm multinationals (Cargill, Sygenta, Monsanto) and NGOs, but largely designed for maize, sugar, rice,

poultry and dairy supply chains. Ag-input and trader credit is considered common, with distributors and traders sourcing their own working capital from commercial and rural banks (Microsave, 2016).

Supply of agri and trade finance to the FFV Supply Chain – predominant crops, supplying actors

Research on supply of finance in Eastern Indonesia reveals that some Rural Banks do target fruit and vegetable crops such as shallots or mango, choosing to focus on commodities grown in the one or two provinces of operation. For most commercial banks and government sponsored provincial banks, the agriculture proportion of total loan portfolio is lower than the national average, ranging from under 1% to 4.9%. This is despite the fact that as many as 60% of households in some regions in Eastern Indonesia (Nusa Tenggara Timor, Nusa Tenggara Barat) sourcing their main income from agriculture (Microsave, 2016). The top five agricultural commodities in these provinces include cassava, sweet potato and peanuts on top of the expected maize, rice and soybean (ibid).

Sharia compliant banks and rural banks dedicate a slightly higher proportion of portfolio to agriculture than commercial banks. There are thousands of co-operatives and credit unions across Indonesia, though only 244 have reached a size of more than 1,000 members. These organisations are more likely to be financing horticultural crop growers. In Eastern Indonesian provinces, four of the top five cooperatives include higher value/perishable or specialty crops in their targeted commodities such as cabbage, horticulture, potatoes, fruit, cloves, nutmeg, and coconut (Microsave, 2016).

Demand for FFV agri and trade finance in FFV supply chain - participant interviews

As a critically underserved segment, it is difficult to source secondary data on the features of demand for agri and trade finance in Indonesian fresh fruit and vegetable supply chains. As such, interviews were conducted with a small number of enterprises including producers, nucleus farm outgrowers, input providers and traders.

Case studies of two agri-food SMEs provide insights into how different financial services are valued by actors in different segments of a horticultural supply chain. One trader saw himself as the financial service provider for farmers of melons such as golden cantaloupe, honeydew and the branded Stella Melon watermelon. This supply chain SME provides credit for of fertilizer, pesticide, and seeds to support the production of certain volumes. Credit and purchasing is with a small group

of land-owning farmers with 1-1.5 ha each. The trader's services post harvest extend to storage, transport and distribution, packaging and marketing and liaison to find the best markets and prices, including supplying to supermarkets. This trader believed the farmers were very wary of banks, preferring him as a trustworthy supplier of credit. The payment cycle for farmers mirrored the buyers, ie. 3-7 days. As a business this SME did not require asset finance as the buyers owned transport trucks. Rather, services to manage weekly transactions and cash flow were more suited to the business model.

Another 'nucleus farm outgrower' grew, sourced and processed 15 leafy green vegetables on a year round basis. Crops included Thai basil, kang kong, bok choi, green lettuce, cassava leaf, cassava root, cucumber, eggplant, and bitter gourds - many grown on a roughly 30 day cycle. This small business engaged 25 workers on two shifts per day for 7 hrs per day, 7 days per week. Many of the 50 people employed in land preparation, harvesting and packaging were from surrounding farms.

The nucleus farm outgrower sold into different channels depending on quality requirements. As the exclusive low-land supplier of leafy green vegetables to the modern wholesaler Bimandiri, this grower sold into 8 supermarkets in Jakarta. Bimandiri as his 'business partner', ordered around 4-5 truckloads per day, consistently paying a premium, but also requiring processing, packaging and shipping within a few hours of harvest. Some 15-20% volume is rejected for quality and is then sold into the wholesale wet market. Whilst the volume and price varies daily, this supplier relationship is valued by the nucleus farmer because Bimandiri will always give some 'buffer' over the market price to retain the relationship, and in particular has gained the farmer's trust by paying regularly and on time.

Exhibit 16: Processing leafy greens for a modern wholesaler that supplies Jakarta supermarkets

Source: Author's own

Tailored financial in the form of fast payment services provide a tactic to address one particular business challenge – the risk of side selling by farmer suppliers. The farmer had invested in training his neighbouring farmers on how to meet quality standards, which at times of higher prices increased the risk that suppliers would sell elsewhere. Strategies to maintain regular supplies include paying farmers daily, at the time of delivery (at market prices sourced from online platforms), and retaining land to grow his own supply to supplement volume or quality shortages.

The SME valued real time transaction services as a means to retain his supplier's loyalty, and expressed the same appreciation for Bimandiri's regular payments. These remittances however, were less frequent – only 3 times on the 10th, 20th and 30th of each month, and hence less vital for managing daily cash flows. Access to debt to build storage, an office, lease more land and to purchase a fleet of five small delivery trucks was collateralised with the farmer's personal assets including his house. Funds for the processing facility was secured through a joint venture arrangement with the buyer - Bimandiri had provided a portion of the capital for building the processing shed. This enterprising SME farmer had borrowed only US$25,000, an amount which would be considered very small to most banks. Too small for SME lending, and much too large for microfinance. This debt was used for working capital, procuring inputs and acquiring fixed assets, suggesting that some flexibility in use of funds is valuable to small scale mid-chain operators.

Takeway Observations

The Indonesian scenario illustrates several findings:

- Different segments of the supply chain value different tailored financial services: aggregators and modern wholesalers need asset finance or equipment rental solutions; producers of fast growing vegetable crops value transaction services and input credit.
- Different supply chain typologies require different tailored financial services: digital transaction services are very valuable in fast growing vegetable crop value chains with regular, sometimes daily, harvests. The timing schedule of planting, harvest and sale of a crop will impact the most valued financial services. For example, transaction services are very important to FFV growers and aggregators. Fast payments can serve to retain the loyalty of suppliers down the FFV chain. Smaller suppliers value daily – often cash - payments more than larger SMEs that have other options to manager cash flow.

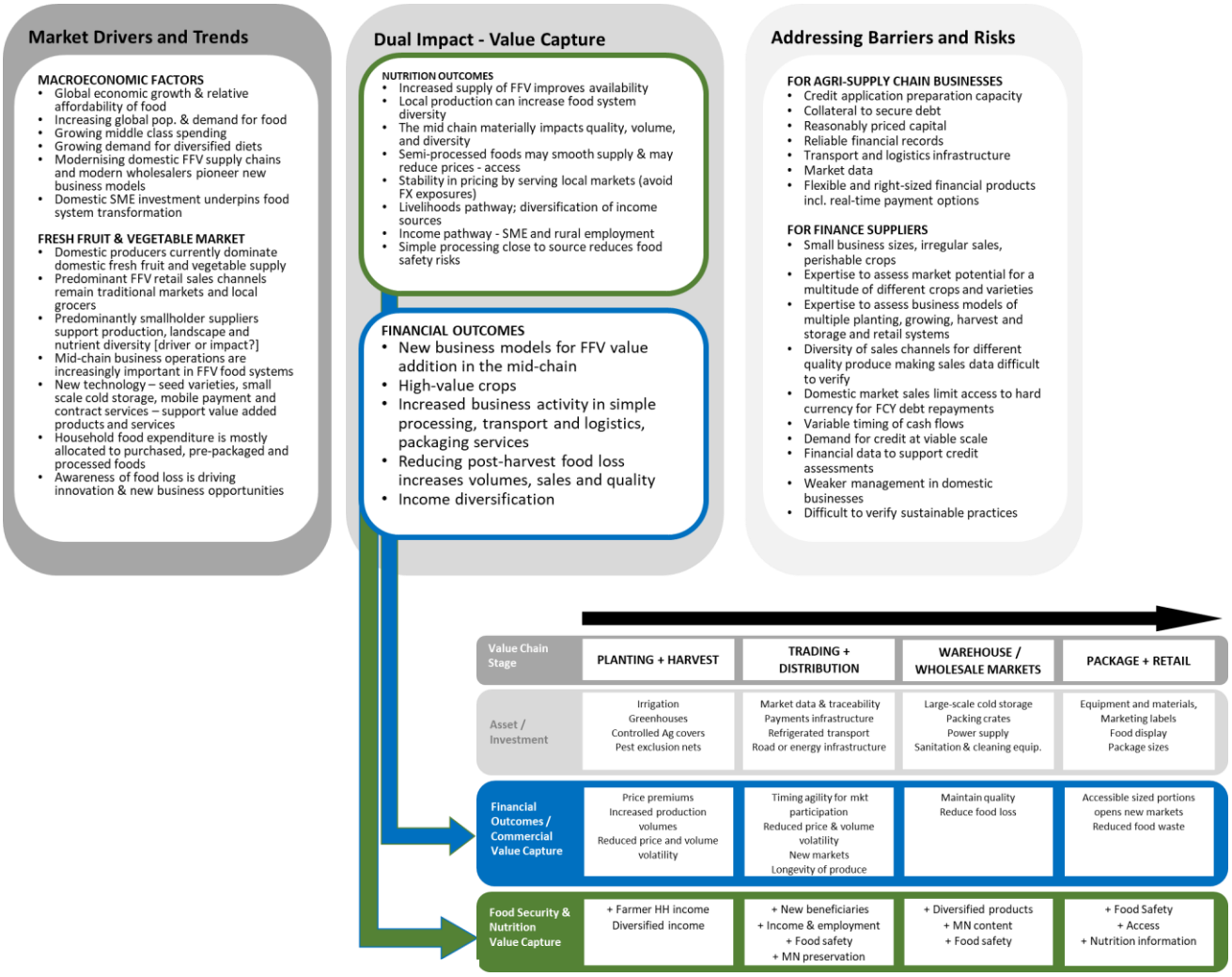
- Debt is not always the most valued financial service, hence access to collateral is not always a barrier to financial inclusion.
- Finance arrangements between supply chain actors extend to fixed asset investments (sheds, trucks) as well as trade and input finance. Banks are not always the most important credit provider. Hence ensuring commercially viable downstream actors are well served with credit and other financial services could be the quickest and easiest way to extend financial inclusion to smaller scale upstream segments. Bundling credit with a physical good (transport, storage crates, seeds) is an effective strategy to extend financial services and can be provided through bringing in a third party, eg. a local bank to provide leases or input credit.
- Financing solutions are more attractive if they augment other innovations serving to strengthen an existing supply chain relationship, eg. in the case of the exclusive Stella Melon variety where an exclusive supply arrangement between a grower and a supermarket was augmented with guaranteed payment within 3 days, a new service provided by a local bank and secured as part of the supply deal.
- A business is more likely to succeed in a FFV value chain if the other actors along the chain want it to succeed. For example seed suppliers will invest to build and sustain their own market. In the case of East West Seeds' Stella Melon variety, the strategic positioning differentiated the seed company as a supplier of exclusive varieties and incentivised them to invest in sales channels and marketing of their buyer's end produce to enhance supply chain relationships

4. Hypothesis + Framework: Presenting the Business AND the Impact Case for FFV investment

The decision to extend credit or make an investment in an agri-business (whether by direct investors like CSAF members, by local financial institutions or by supply chain operators offering value chain finance) is founded on the investor's assessment of the feasibility of the recipient's claim to be able to generate financial return over time. This decision at one level is based on an individual business model and the entity's capacity. At another level, the external environment influences that entity's viability and presents opportunities to leverage observed market drivers and trends with new business models. As discussed earlier, rapidly evolving economic, social and demographic drivers are building demand for fresh fruit and vegetables across the developing world. These trends sit alongside clear opportunities to 'capture value' in the form of both financial return and nutritional impact from horticultural supply chain businesses.

Utilizing the traditional impact investor approach of seeking dual outcomes, this analysis presents the business case for investment in FFV supply chain businesses, providing new arguments on how to fill the funding gap for improved nutrition and food security. The following section examines market drivers and trends in FFVs in developing countries, with particular emphasis on Southeast Asia and Indonesia, followed by economic and food security value capture opportunities at an aggregate level. It then then presents the food security and economic value capture opportunities for specific actors operating along the supply chain, based on the type of investment or intervention required by each actor. Exhibit 17 presents this framework.

Exhibit 17: Structuring the business case for FFV investment: Drivers, Value Capture & Risks



Source: Author's own creation

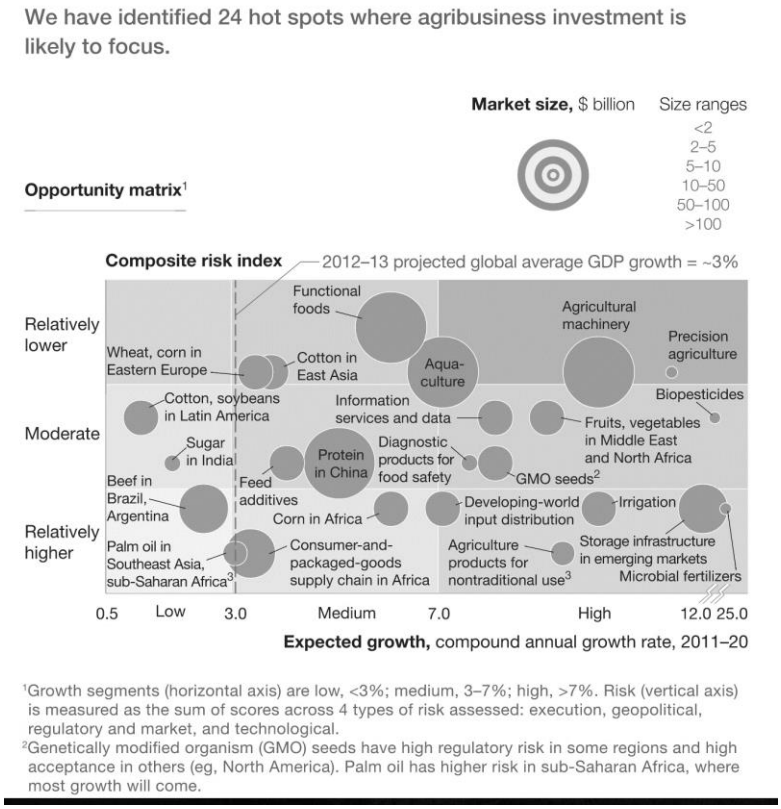
5. Market Drivers and Trends

5.1. Macro-economic Factors and Food Systems

Whilst increasing urbanisation, a growing middle class and changing diets present challenges to dietary quality, these demographic shifts can also be viewed as business opportunities. Global fruit and vegetable production has grown at over 6% per annum over the 20 years to 2011, and the Asia Pacific region supplies half of global fruit production and 80% of the world's vegetables (China alone accounts for 50%) (FAOSTAT, 2014). Research from McKinsey has identified twenty four 'hot spots' likely to be the focus of global agri-business investment (Goedde, Horii, & Sanghvi, 2015). Predictions of exceptional compound annual growth of over 10% include irrigation,

agricultural machinery, and storage infrastructure in emerging markets, depicted in Exhibit 18. The drivers changing demand for, and supply and distribution of, food are discussed below. These economic and demographic changes are materially impacting international and domestic food systems, and offer opportunities for new or improved business models to deliver greater volumes of fresh fruit and vegetables to meet market demand.

Exhibit 18: Concentration of agricultural investment 2011-2020



Source: (Goedde et al., 2015) Pursuing the global opportunity in food and agribusiness, McKinsey & Company.

Global Economic growth, especially in Asia, supporting relative affordability of food

Regional and national economic growth in Asia has been strong in recent years. The International Monetary Fund estimates the growth rate for emerging markets and developing economies in 2017 to be 4.6%, and ASEAN countries (Indonesia, Philippines, Thailand, Vietnam, Malaysia) should expect GDP growth of over 5% into the medium term (International Monetary Fund, 2017). The formal SME sector in Asia, already accounting for 62% of the region's total employment and 42% of GDP, is expected to grow by 2% to 4% each year for the foreseeable future (Asian Development

Bank, 2015). As economies grow and populations find greater employment opportunities, households will have greater purchasing power, greater disposable income and micronutrient-rich food will become more affordable as a result.

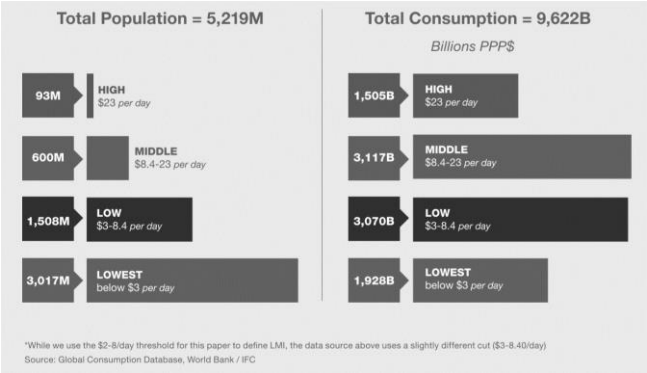
Growing population demanding greater food volumes, mostly in developing economies

According to the UN's World Population Prospects 2017 revision, the world's population will grow to 8.5 billion by 2030 (UN Department of Economic and Social Affairs DESA, 2017). The world must produce significantly greater volumes of food to meet the demand from this additional 1 billion people in the next 14 years. Currently 60% of the world's population live in Asia; 90% of the next billion people will be shared equally between the African and Asian continents (ibid). Growth in food demand on 2005 levels is estimated to be between 49% - 98% to 2050 (Valin et al., 2014), and the FAO estimates that global food production will need to rise by at least 60% on the same time scale (Alexandratos & Bruinsma, 2012). Whilst much of the demand for calories may be met by cereals and animal source foods, the volume of growth will still see significant demand for fruits and vegetables, pulses and roots and tubers, particularly for the provision of micronutrients in diets.

Growing middle class spending - on value added, convenient, packaged foods

The Brookings Institute projects that by 2020 and for the first time in history, more than half of the world's population will live in middle or rich (sic) households (Kharas, 2017). This is driven by an increasing middle class, with up to 140 million people added annually, the majority of whom (88% of the next billion new entrants) will live in Asia (ibid). Current middle class spending is estimated to account for one third of the global economy (ibid). This is graphically emphasised in Exhibit 19, with 600 million middle class consumers (blue) spending double on consumption than the 93 million high income earners (green), and the 1.5 billion low income population spending 60% more than the 3 billion people in the lowest income segment. These two segments account for $6.2 trillion of a total $9.6 trillion in consumption spending (World Bank's Global Consumption Database in (Bannick et al., 2015).

Exhibit 19: The Low-and Lower-Middle-Income Opportunity - Consumption



Source: (Bannick et al., 2015), Omidyar Network's Frontier Capital: Early Stage Investing for Financial Returns and Social Impact in Emerging Markets

Food and beverage consumption from low and middle income segments alone is estimated at $2.4 trillion annually according to the World Bank's Global Consumption Database ("Global Consumption Database | The World Bank," 2010). In Indonesia consumer food spending is escalating, having doubled twice between 2000 and 2010. Food spending accounts for two-thirds of total consumer spending (Minot, 2013) and 31.5% of expenditure is on food consumed at home (USDA ERS Food Expenditure Series, 2016). For urban consumers, 15% of that spending is on fruits and vegetables, for rural consumers it is 17% (Reardon, Stringer, Timmer, Minot, & Daryanto, 2015).

Combined with urbanising societies and the globalisation of food preferences, this rapidly growing middle class demographic is linked to transforming food systems and nutritional challenges from changing diets (Reardon & Timmer, 2014). The triple burden of malnutrition incorporates growing obesity and over-nutrition linked to the increasing prevalence of cheaper convenience foods (especially attractive to time poor women), modern food retailers preferring packaged 'long shelf life' foods and growing foreign investment into global food supply chains (Pinstrup-Andersen & Watson, 2011). But these transformations also present opportunities to capture market share by supplying nutritional foods with features not only important for health and food security (available, accessible and affordable, safe and stable, but also those features attractive to consumers: convenience, enhanced preservation for appearance and taste, and smaller packages for price affordability) (HLPE, 2017). These significant market trends suggest a growing market for fresh and semi-processed fruits and vegetables.

Growing demand for diversified diets

Increasing demand for differentiated or better quality fruits and vegetables offer new business opportunities. As households secure additional income, greater diversity in food baskets is demanded alongside additional protein and animal source foods. In Indonesia, the main growth in per capita food consumption is in high value foods - animal products, fruits, vegetables, fish, oils and prepared food; from 2000 to 2010, daily per capita consumption of fruits increased by 30% and vegetables by 11.5% (BPS, 2011 in (Minot, 2013). This increasing consumer demand for fruits and vegetables is characterised by high willingness to pay for distinct varieties, assurances of safety or organic standards, more uniformity and quality, and private labels (Minot, 2013), all requiring product 'upgrading' services from supply chain actors. Such requirements are pressing FFV value chains to re-evaluate their structures and functions, in order to meet the higher standards required by consumers.

Modernisation of supply chains, supermarkets & modern wholesalers

The increasing penetration of modern supermarkets in food retail markets has placed increased pressure on producers for consistency, quality and supply chain visibility (Minot, Stringer, Umberger, & Maghraby, 2015). Whilst in Indonesia modern retail is currently a market niche in horticulture, the trend is towards greater shares as seen in other developing countries such as Thailand (ibid). The related evolution of supermarket procurement systems towards efficiency has supported a new type of actor in food supply chains. The 'modern dedicated wholesaler' specialises in supplying consistent year round quality goods to the supermarket sector, and can enforce private quality and safety standards and contracts with preferred suppliers for the supermarket (Timmer and Reardon in (Von Braun, Díaz-Bonilla, Pinstrup-Andersen, & International Food Policy Research Institute, 2008)). Wholesale and retail buyers want to centralise contracts, shipping and distribution arrangements. This aggregation function is key to accessing markets for any crop, but especially for FFV where regular supply of sufficient quantities at certain grades is demanded by buyers. Wholesale market infrastructure investment by governments has been influential for the emergence of modern wholesalers in Indonesia, Asia and other developing countries and regions (Reardon, 2015). Increased public investment in electricity, roads and transport infrastructure enable SME trucking and logistics firms or local rural traders to benefit from their own investments in small trucks to supply more distant urban wholesale markets. Private sector investment can result in consolidation of these actors, supporting more uniform operations in the grading, tracing and

storage of produce (Reardon, 2015). In markets traditionally dominated by loose disaggregated supply chains - such as those for FFV in Indonesia - modern wholesalers offer new business model opportunities to enhance the market for produce and facilitate access of micronutrients to the rising urban population.

Food system transformations are underpinned by domestic SME investment

In FFV supply chains the post farm-gate segments and mid-chain operators are just as important as producers in ensuring that the best quality and maximum volume of produce reaches the market (Reardon & Timmer, 2014). These operators are usually micro or SME businesses, and as discussed earlier, estimates of the growth and contributions of SMEs to emerging economies are significant. There are close to 365-445 million formal and informal micro-and-SMEs in emerging markets of which 80-100 million are formal enterprises (International Finance Corporation, 2010). Formal SMEs alone are estimated to contribute up to 45% of total employment and up to 33% of GDP in developing economies (ibid). Indonesia's 57.9 million MSME's underpin the entire economy – as at 2013, the most recent reported data, MSMEs account for 99.9% of total enterprises, comprise 97% of the workforce and constitute 60.3% of GDP (Asian Development Bank, 2015).

Investment of largely domestic capital by these small-medium scale operators has been termed the 'quiet revolution' (Reardon & Timmer, 2014). Self invested SME funds have been allocated primarily into first-stage processing, upstream agricultural services and wholesale operations (IFAD, 2016). Growth and investment by domestic businesses can promote consolidation of smaller scale actors, and the emergence of new specializations. This is distinct from foreign direct investment (FDI) deployed by commercialised multi-nationals and national conglomerates that favour more direct control over their supply chains, often extending to contract purchase agreements with farmers.

5.2. Fresh Fruit and Vegetable Sectors

Domestic producers currently dominate domestic fresh fruit and vegetable supply

From a business perspective, growing retail demand driven by middle class spending offers supply chain businesses greater growth opportunities than do many export markets. Food value chains in developing countries are already primarily oriented toward domestic markets. Globally, developing country food exports account for only 1.9% and 8.4% of domestic production in raw tonnage and value, respectively (Catholic Relief Services in (Gómez et al., 2011)). Imports are a minor share of

total food consumed in most Asian countries (Reardon & Timmer, 2014). In Indonesia the share of horticulture imports of domestic supply volumes is small at 7.1% in 2012, though growing, having risen from 5.1% in 2005 (Minot et al., 2015). The Indonesian government has a number of policies aimed at decreasing the competitiveness of imported FFV as it seeks food sovereignty, namely through its 2012 "Farmers Protection and Empowerment Act". This legislation imposes import quotas on Australian fresh produce and restricts access to main ports claiming concerns over quarantine and illegal imports (Sampson, 2017). This import substitution strategy is not generally accepted as an effective policy lever for promoting domestic productivity and efficiency and is not expected to be effective in isolation of significant private sector agri-investment.

Examination of the scaled integration of smallholder farmers and farmer groups into national markets in East Asia finds significant demand for domestic fruit and vegetables. IFPRI & ACIAR research found that the Indonesian urban consumer is the main consumer for domestically produced fruit and vegetables after examining high-value crops such as tomatoes, potatoes, chilies and mangos (Reardon, Stringer, et al., 2015). Urban centres concentrate the demand for food – for example production of perishables such as fresh fruit and vegetables, poultry, dairy and associated primary processing operations tend to grow faster closer to large urban metropolis' and regional cities (Reardon, Boughton, et al., 2015). Corresponding access to infrastructure (roads, cold chains, etc.) are especially vital for businesses in FFV chains. Importers recognise the opportunities - fresh fruits and fresh vegetables have been identified as categories with the strongest sales potential for US food producers, along with processed fruits and vegetables (fruits juices, frozen and canned vegetables, dressings and seasonings) (USDA, Fahwani, & Wright, 2016). It remains for domestic supply chain actors to capitalise on these existing food system dynamics to continue to meet consumer preferences with domestic produce.

Predominant fresh fruit and vegetable retail sales channels continue to be traditional markets and retail grocers

Across low and middle income countries, traditional food value chains retain at least two thirds market share of FFV sales at the expense of modern retail: 60% in the case of Thailand and Mexico, and 90% in the case of Kenya, Zambia and Nicaragua (Gómez & Ricketts, 2013). In Asia, formal retail outlets still sell only a small proportion of the total volume of fresh fruit and vegetables consumed (Minot et al., 2015), meaning local 'wet markets' and traditional small retailers ('warungs' in Indonesia) retain influence over the quality, variety, product features and volumes of what makes it into a household's food basket. Research on urban households in three large cities of Indonesia find that consumers

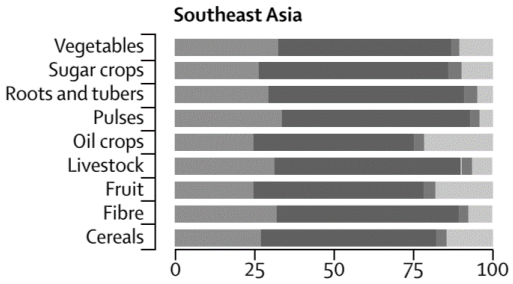
spend about 31% of their food budget at warungs, 24% at traditional wet markets, and 19% at modern outlets, and the share of vegetables purchased at modern retail outlets is much smaller at less than 5% (Minot et al., 2015). Another 2010 Nielsen Shopper trends survey showed that buyers purchased 53 percent of fresh vegetables, 70 percent of fresh meat, and 67 percent of fresh fish in traditional markets (USDA et al., 2016). Acknowledgement of these persistent shopping habits is crucial to identifying business opportunities and scalable nutrition improvement strategies. Traditional grocers can actually offer nutritional benefits to poorer households by offering greater price & quality differentiation, for example at the end of the day, than a minimart or supermarket with its standardised produce offerings. A University of Adelaide study (Hery Toiba, 2011 cited in USDA et al., 2016)) showed that perceptions amongst Indonesian consumers favour traditional markets on features such as price and product information. Traditional retailers are believed to offer lower costs across all categories of food except dairy and processed food, and believed to be more transparent and forthcoming with product information for vegetables. Traditional small grocers in Indonesia sell local food and drinks that are familiar to their customers. This feature, along with location and personalised services, support their popularity with households against organised retail (USDA et al., 2016).

FFVs are grown by many SH suppliers who support production and nutrient diversity

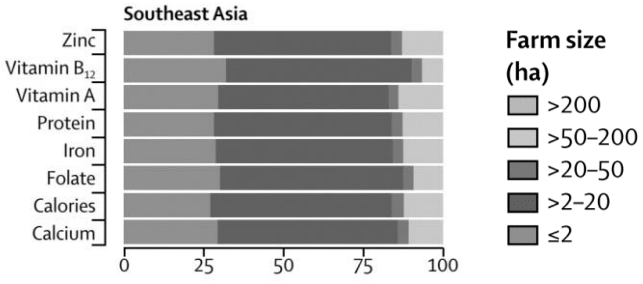
Many high value crops, which include most FFV, are more suitable to be grown in small plots, historically with less mechanisation, and hence are often grown by smallholder farmers. These farms make a vital contribution to the current structure of commodity production, food basket composition and micronutrient diversity. Diversity of the food species in a diet contributes to food security, nutrient adequacy and diet quality (Herrero et al., 2017). This vital contribution that millions of smallholder families can make to healthy choices for consumers will become increasingly valuable as pressures on land use and other resource constraints escalate with climate change and a growing global population. Small farms (less than 20ha), which often contain a broader mix of crops and livestock, are the most significant contributors to the diversity of crop species and diversity of micronutrients in the food system (Herrero et al., 2017). This is particularly important for poor people (Townsend, 2015). Small farms in diverse landscapes produce more than 75% of most food commodities in Sub-Saharan Africa, Southeast Asia, South Asia, and China. A study in the Lancet finds that the majority of vegetables (81%), roots and tubers (72%), pulses (67%) and fruits (66%), as well as the majority of global micronutrients (53–81%), are produced in diverse landscapes (ibid). This situation is very evident in South East Asia, as can be seen in Exhibit 20 and Exhibit 21, below.

Exhibit 20: Production of key food groups in South East Asia by farm size
Exhibit 21: Distribution of nutrient production by farm size

20.



21.



Source: (Herrero et al., 2017) Farming and the geography of nutrient production for human use: a transdisciplinary analysis

Mid-chain business operations are increasingly important in FFV food chains

IFAD's Rural Development Report (2016) highlights the changing roles of actors and opportunities for new businesses as value chains lengthen. With the reduced importance of the village trader and greater roles for urban SME wholesalers and other middle chain actors, the report states that:

> *"the leading players in the downstream changes tend to be a small number of large corporations, while the revolution in the midstream parts is, in large part, a silent one, with some large firms, but mainly with hundreds and thousands of small and medium-sized firms transforming the ways in which food production is supported and food products are processed, wholesaled and transported"* (IFAD, 2016).

Supermarkets do not source directly from farmers, continuing to prefer to source from wholesalers (Reardon & Timmer, 2014). Supply chains are lengthening geographically, but with fewer 'intermediating' actors, as retailers seek more regular supply from a larger catchment area. According to Reardon & Timmer, this trend opens up opportunities for modern logistics companies which provide services such as warehouse management, ICT system integration into retail and distribution systems of companies, cold chain development, and packaging (Reardon & Timmer, 2014).

In Indonesia, there is an emerging business model of the 'specialised wholesaler' expert in the grading and packaging of horticulture produce for retailers or modern processors (Reardon & Timmer, 2014). For example in Java, the rapidly growing FFV supplier Bimandiri describes itself as a 'Trading Service for fresh fruit and vegetables' ("PT BIMANDIRI AGRO SEDAYA About Us," 2017). In addition, Bimandiri provides new products to retailers, as it repackages and resizes different grades of produce

for small scale restaurants, as observed in observations and interviews according to interviews conducted as part of the study.

Exhibit 22: Worker's package individual lettuce leaves into attractive bunches for the Bimandiri brand.

A "nucleus farm out-grower farmer" supplier borrowed to purchase efive small trucks and a packing shed, buying shallots and leafy greens from neighbouring farmers to supplement his own

Source: Author's own

Examination of the tomato market in Indonesia found increasing importance of new wholesale players in fresh vegetable markets: termed 'modern wholesalers', this non-traditional, yet not truly modern supermarket channel comprises '*large urban wholesalers that eschew multilayered supply chains and buy directly from farmers'*. (Hernández et al., 2015). Other emerging businesses include specialist logistics groups providing dedicated cold storage, digitalised warehousing and transport. Hence enterprises operating in the wholesale markets are increasingly crucial for FFV supply to both households and to the modern retailers.

Availability of new technology and services support value addition in supply chains

'Ag-tech' is a growing sector attracting investment and innovation in digital, mechanical, production, distribution and communication technologies, many of which can be utilised by FFV growers, processors and retailers. Examples include the development of new plant breeding technologies such as CRISPR which may be used to breed tropical climate appropriate varieties of vegetables, solar energy to power cool storage and blockchain technology to streamline aggregation and distribution.

The value and innovation in small scale cold storage and transport systems has been referred to above. Digital and mobile payment and contract services support FFV growers in particular with their daily harvest and sales patterns. Much is claimed on how the internet of things, 'IOT', is going

to change farming and food systems practices for those farmers that can afford smart sensors and connectivity and telecommunication infrastructure. As these become more common, costs will drop, promoting applications for small scale farmers to manage water requirements, soil quality, input provision, market data, and fuel use in emerging economies as they integrate into more formalised supply chains serving urban populations.

Consumer demands for traceability, quality and certification standards are already impacting high income country consumption patterns and promoting investment in grading and traceability systems (Reardon, 2015). Whilst demand for particular traits is mostly evident for international traded or exported products, the growth in the urban middle class in developing economies is likely to increase requirements for local horticulture produce. Examples of enterprises drawing on new technology to create value and serve smallholders are given in section 7 below.

HH food expenditure is mostly allocated to purchased, pre-packaged and processed foods

As consumers prioritise qualities such as convenience, aesthetics, and shelf life, they offer new markets for new FFV products such as simple processed or pre-cut fruits, salads, vegetables for soups, dried fruits, and juices. Indonesian rural families increasingly purchase food, rather than grow crops for their own consumption: purchased food is about 80% of total food value, and 63.3% of total food expenditure is on processed food (that is, not staple cereals) (Reardon et al., 2014). In urban households 72.4% of food expenditure is allocated to processed foods. The dietary transformation observed in changing preparation and consumption habits means the roles of the mid-chain – wholesale, processing, transportation, storage, packaging, and distribution - are extremely impactful on both rural and urban household food consumption. Changing habits increase the opportunity for mid-supply chain actors to develop new value added products, offering potential to not only influence the nutritional quality of household diets but also capture new economic value from new business lines. Examples include prepared fruits, as can be seen in Exhibit 23.

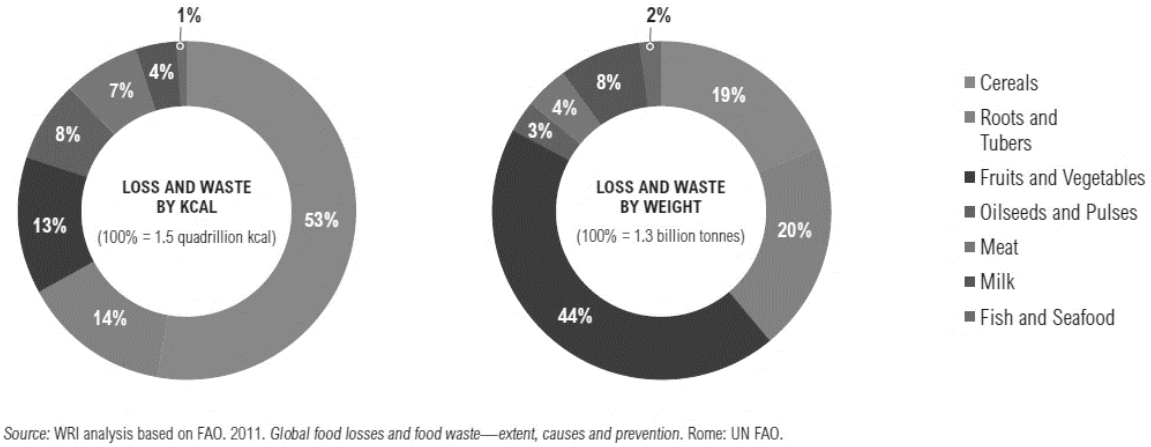
Exhibit 23: 'Ready to eat' prepared pineapple; peeled mandarins, oranges, and cut melons on display in an urban Jakarta supermarket.

Source: Author's own

Awareness of food loss is driving innovation and new business opportunities

The FAO estimates that one third of the edible parts of food produced for human consumption is lost or wasted (Gustavsson, Cederberg, & Sonesson, 2011). In South East Asia this equates to 460kgs per capita, and largely occurs along the supply chain in production, harvest, post-harvest activities, processing and distribution (ibid). Globally, loss by weight is highest in fruits and vegetables, and is calculated to be as much as 44% (Lipinski et al., 2013). Exhibit 24 below shows loss and waste by calories and weight for different food groups.

Exhibit 24: Share of Global Food Loss and Waste by Commodity, 2009

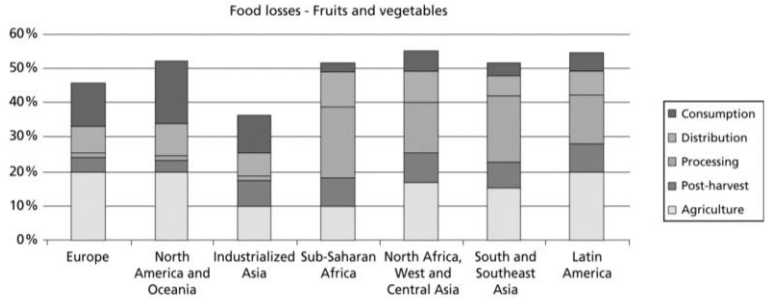


Source: WRI analysis based on FAO. 2011. *Global food losses and food waste—extent, causes and prevention*. Rome: UN FAO.

Source: (Lipinski et al., 2013)

This pattern of loss of fruits and vegetables is replicated across all developing economies; in South and South East Asia over 50% of initial production is lost along the supply chain as represented in Exhibit 25 below. This is partly attributed to the rapid deterioration of these perishable crops in warm and humid climates, and exacerbated by poor storage facilities and transport infrastructure, lack of processing facilities, and inadequate wholesale and retail facilities with suitable storage and sales conditions (ibid). Biological and environmental factors causing loss in FFV supply chains include improper maturity/ripeness at harvest, poor initial quality, mechanical damage, inadequate sanitation, inadequate drying or dry storage, decay, improper product temperature, excessive water loss, and delays between harvest & market (Lipinski et al., 2013).

Exhibit 25: Part of the initial production lost or wasted at different stages of the supply chain for FFV in different regions



Source: FAO 2011 Global food losses and food waste – Extent, causes and prevention (Gustavsson et al., 2011)

The world has acknowledged the costs associated with food loss and waste, estimated to be USD $940 billion per year (Hanson & Mitchell, 2017) with its inclusion in the Sustainable Development Goals (SDGs, or 'the global goals'). SDG 12.3 expresses the goal to:

"*By 2030, halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses"* ("UN Development Program Goal 12 targets," 2017).

The potential for value capture in Indonesia is significant – the country ranks second to last in the Economist Intelligence Unit's 2016 Food Sustainability Index Food Loss and Waste category despite the contribution of agriculture to GDP being one of the highest of the evaluated countries. Factors significantly impacting this ranking for Indonesia included a) food lost as percentage of total food production of the country, b) food waste per capita and c) quality of the road infrastructure causing distribution level loss (Economist Intelligence Unit, 2016). Value can be captured by reducing the

costs of loss, or realising additional revenue streams through new products, new market access or branded premiums.

Recognition of the huge economic and nutritional value of food loss and waste is driving new, price appropriate, easily deployed solutions designed to cap the costs of pre- and post-harvest loss as the private sector becomes increasingly aware of the long term production constraints and issues with disposal in landfill. Studies in African and Asian countries (Nigeria, Ghana, and Vietnam) suggest that stripping cassava tuber with new mechanical peelers rather than by hand could lower losses from rot by about 44% (M Schuster & Torero, 2016). Returnable plastic crates have proven to reduce losses in tomatoes from 50% to 5% in Afghanistan, and loss of mangos and avocados from 30% to 6% (Winkworth-Smith, Foster, & Morgan, 2015).

Corresponding to reducing the costs of volume loss and quality deterioration is an opportunity to grow revenue for businesses and countries. Increasingly the SDG 12.3 target is recognised as a business opportunity - applying a 'food loss lens' supports identification of this potential economic value capture from produce currently lost along the supply chain. We know that use of cold storage reduces food loss in vegetable supply chains (Bart Minten, Thomas Reardon, Sunipa Das Gupta, Dinghuan Hu, & K. A. S. Murshid, 2016) and an introduction of refrigeration supporting improved quality could introduce new markets for produce. For example, India loses 20–50% of its fruits and vegetables because of a lack of refrigerated trucks and storage. Estimates predict that improving the cold chain for bananas could lift exports from 3,000 containers to 190,000 containers annually (Winkworth-Smith et al., 2015). McKinsey suggest that in particular logistics and distribution offer big 'value-creating investment opportunities' in recent food and agri-business industry analysis (Goedde et al., 2015).

Accelerating progress toward achieving SDG 12.3 by 2030 is the exclusive focus of the coalition of governments, businesses, international organizations, research institutions, farmer groups, and civil society, formalised as 'Champions 12.3'. Its recent publication "The Business Case For Reducing Food Loss And Waste" analyses the financial impact of food loss for national governments, cities and large corporations. The study concluded that financial benefits of taking action outweigh the costs of food waste reduction interventions (Hanson & Mitchell, 2017). In a study of 1,200 businesses, they found a median benefit-cost ratio of $14, that is, for every $1 of investment spent on reducing food loss and waste, a $14 return was realised. Financial benefits resulted from actions such as increasing the share of prepared food that gets sold onward to customers and introducing

new products lines from food that would otherwise have been wasted. The analysis focuses more on food manufacturing, retail and food service operations, rather than further up the supply chain, and finds that businesses closer to the production end had lower, but still positive, benefit-cost ratios. The study demonstrates the growing recognition that innovation in supply chain management can be financially viable. Other possibilities for economic value capture through new revenue sources include developing new products by processing damaged or poor quality produce grades, or usage of 'inedible' stocks for animal feed, compost fertilizer or energy generation.

6. Value Capture Opportunities from FFV businesses

Consideration of the business case for an investment – that is, where is the financial return going to come from - is crucial to increase the supply of finance. A financial institution or investor must consider the payback potential even whilst also seeking social and environmental outcomes. This standpoint - looking jointly at both financial and nutrition and food security value capture from investments into FFV markets - can help mobilise additional supply of funding.

6.1. Nutrition & Food Security Value Capture from FFV enterprises

With the rise of urbanization, rural – urban food chain links become central to food security and to the food system as a whole. If food security efforts remain focused on the production stage and farm yields, significant opportunities will be missed to improve nutrition at scale by leveraging system wide food market transformations from urbanization, dietary change, supply chain developments and changing factor markets (labour, capital, financial intermediation and land). The Committee on World Food Security's High Level Panel of Experts (HLPE) on Food Security and Nutrition acknowledge the 'critical link' in food systems between producers, markets and consumers provided by small-medium enterprises (HLPE, 2017). Its 2017 Nutrition and Food Systems Report highlights the opportunities to improve the nutrition value chain through attention to each food supply chain segment, in particular post-harvest storage, processing and distribution of fruits and vegetables (ibid). They suggest a focus on maximising nutrition entering the supply chain and retaining it through tailored interventions at each stage (ibid). The FAO also recommends extending beyond production diversity and supply volumes to post farm-gate supply chain opportunities in processing, storage, and preservation of food. Reducing post harvest loss and improving processing is considered particularly impactful for realizing nutritional outcomes by increasing and prolonging food availability, access and consumption, preserving the nutrient content of the food, increasing

income with value-added processing or employment, steadier income flows throughout the year, and employment in the processing cycle and improving food safety (Herforth, 2013).

These outcomes can be realised by changing total supply volumes in the market, and by increasing the nutritional content of existing produce by changing how it is grown, transported, processed, packaged and retailed. These pathways are discussed in more detail below.

To realise these tangible food security outcomes as the world's population expands we need greater investment in more efficient, better functioning FFV supply chains. Some claim that the productivity and efficiency of mid-chain actors is of equal importance to food security of developing countries as that of farm yield. In Asian food economies processing, storage, logistics and wholesale in the middle of the chain accounts for 30-40% of costs in food supply chains (Reardon, 2015). Strategies to improve efficiencies and control costs include reducing food loss in shorter supply chains, improving the timing of sale through targeted harvest and better storage, and reducing packaging sizes to meet changing consumer preferences. The HLPE on Food Security and Nutrition promotes reduction in food loss and waste of fruits and vegetables through cold chains and refrigerated transport as are key to reducing spoilage (thus increasing volumes and retaining nutrients), increasing food safety, improving dietary diversity and creating viable export markets for producers (HLPE, 2017).

Similarly, promoting and maintaining diversity in local production varieties has a crucial influence on national health. The FAO rrecommends diversification by increasing the production of nutrient dense foods like horticultural crops, legumes and animal source foods (Herforth, 2013). Herrero et al find that the capacity for farmers on small plots (<20ha) to produce and sell fruits and vegetables has significant implications on the long term availability of nutritional diets of entire populations (Herrero et al., 2017). Farm areas in Southeast Asia with higher diversity, ie. in areas with small farms (≤20 ha), produce more than 75% of most food commodities, most of the vegetables (81%) and supply most of the essential nutrients (>80%) consumed in those countries (similar patterns are observed in SSA, South Asia and China) (ibid).

National food economies depend on domestic food supply, are dominated by urban food demand (two thirds to three quarters), and 50-70% of prices paid by consumers in Asia are influenced by post-harvest supply chain operations (Reardon & Timmer, 2014). Both informal small scale and modern large scale mid-chain actors are already influencing diets as they invest large sums in rural-

urban supply chain operations, facilitating the supply of non-grain products to urban markets (Reardon & Timmer, 2014). Drying and packaging fruits or canning, freezing or fermenting vegetables supports nutrient retention, longer storage life and broader distribution networks (HLPE, 2017).

Increased investment in FFV value chains aimed at increasing efficiency of intermediation activities can help reduce the price spread (i.e. the difference between retail and farm gate prices) and can help address the food price dilemma (Gómez et al., 2011). That is, to incentivise consumption we need lower prices, but lower prices harm producers - those suffering from food insecurity, the farmers themselves. Fruits and vegetables tend to be very expensive in poorer countries (Teo et al., 2013) and this is a significant barrier for consumption of the recommended daily in-take, particularly in rural areas. For example, as a study across 18 countries found, households in low income countries spend 29% of their income to purchase one serving of fruits and 11% for one serve of vegetables, making the recommendation of two servings of fruits and three servings of vegetables per day almost impossible for many people (V. Miller et al., 2016). In Indonesia, households spend 31.5% of their consumer expenditures on food, in comparison to many high income countries where expenditure is often less than 10% (USDA ERS Food Expenditure Series, 2016). Efficiency gains by improving operating practices of supply chain businesses and new business models can better link demand ~~for local products~~ to supply and increase volumes of produce available in domestic markets. This can improve accessibility by reducing the food price dilemma – the gap between producer price and the retail price, allowing producers to earn more and consumers to pay less.

In developing countries premature harvesting impacts nutritional quality of crops. Poor farmers sometimes harvest crops too early because of a lack of food or an urgent need for cash later in the growing season. As such, crops incur a loss in nutritional and economic value, and may get wasted if not suitable for consumption (Gustavsson et al., 2011). Reducing loss in quality at the production stage (planting, growing, pest & contaminant management, harvest, on farm storage) as well as loss in volume along the chain is a contributor to addressing this food price dilemma (Gómez et al., 2011). It allows the farmer to differentiate their products by quality and secure better process for better quality produce, whilst improving the supply in the market.

We must also acknowledge the indirect benefits that accrue to participants in rural economies as business operations are improved/commercialised, creating additional employment opportunities and increased local expenditure (Gómez et al., 2011). Rural non-farm employment in Asia is more

important to households than farm wage labour, making up 40% of rural incomes. This employment comes from services (commerce/transport including of food products and inputs, personal services like repairs or tailoring, and construction) and about a quarter to a third, manufactures (HHR, 2010 in R&T14). This rural income, much generated from off-farm businesses in the non-grain food value chain, provides funds for further food supply chain services and on-farm investment (Reardon, Boughton, et al., 2015; Reardon & Timmer, 2014). And of course it reduces livelihood vulnerability and poverty of farm households, supporting greater food security through access and availability.

Maintenance of food quality and safety is particularly important for fruits and vegetables (HLPE, 2017). Whilst highly nutritious, they are most responsible for food-borne diseases. One critical challenge is aflatoxin. Many staple foods and nuts can be contaminated with aflatoxin if not dried and stored properly, and this may have serious health consequences and may be linked to stunting in children (Unnevehr & Grace, 2013). Perishable foods require cold chain storage and transport unless consumed within a short space of time and very close to their place of origin.

Recommending fruits and vegetables for nutrition without addressing food safety issues could actually result in net worsening of health (HLPE, 2017). Conversely, investments in storage and transport, including cold chains, can have a significant positive human health impact.

A word on SH value capture – nutrition & livelihoods

According to The World Bank's Global Consumption Database, the world's poorest spend as much as 60 per cent of their income on food ("Global Consumption Database | The World Bank," 2010). As a subset of this group, smallholder farmers can benefit in particular from producing FFV. Vegetable crops can be more suited to small land holders as the yields and productivity are high, the value of the crop is high, and production tends to be more labour intensive. From a cash flow perspective, horticultural crops include both perennial and annual crops, supporting more regular, less variable annual incomes for farmers. Post farm-gate processing or transport enterprises can improve nutrition by increasing employment opportunities and provide income from a processing market for food sold during the off-season (Herforth, 2013), given for smallholders purchased foods play a greater role in dietary diversity than own production (Sibhatu & Qaim, 2017).

For small producers, the presence of modern wholesalers to play an aggregation role is critical to accessing modern supply chain channels, particularly for the important transmission of food safety

and quality standards. Aggregation can help secure long term contracts, perhaps at set prices, from the traders and protect producers from price volatility (Von Braun et al., 2008). It is difficult to supply supermarkets without access to expertise, irrigation, trucks and packing sheds. Land size is not so much of an important asset to determine participation (ibid), but rather access to manual labour for harvesting multiple crops per year, sorting and packaging is crucial. These functions, if performed locally by a nucleus farm out-grower farmer can stimulate local employment (Hernandez, Berdegué, & Reardon, 2015).

But we cannot expect these outcomes to be realised unless supply chain actors invest in their businesses or change practices. Hence we must examine the potential economic value capture that could support the business case for those operators willing to change practices, try new business models or take on debt to invest in growth. This rigour underpins access to finance for a business.

6.2. Financial Value Capture from FFV agri-businesses

The most influential actors in commercialised and developed food systems are mid-chain actors (Canning, 2011). In more developed markets horticultural value chains are tighter with extensive coordination between all actors in the chain because of the need for cold or controlled atmospheres to prevent perishables spoiling, for rapid information flow, performance monitoring, joint decision making and traceability concerns (Handayati, Simatupang, & Perdana, 2015). But in many developing economies FFV food value chains are loose, and comprise many producers and actors which sell to local domestic wet markets where the bulk of households currently purchase their produce (Reardon & Timmer, 2014). Hence as emerging economies evolve, the processing, marketing and packaging of foods have been calculated as significant and growing investment opportunities in emerging modern supply chains. The Business and Sustainable Development Commission estimate business opportunities from implementing the SDGs in the food and agriculture system of up to $2.3 trillion per year (Business and Sustainable Development Commission & Alpha Beta, 2016). This estimate includes between USD $455 and $860 billion per year from specific businesses supplying low income food markets (by development of better products and distribution systems to meet food demand of low-income consumers), reducing post harvest waste along the supply chain, improving smallholder access to technology and from micro-irrigation (Business and Sustainable Development Commission & Alpha Beta, 2016).

The growing demand for fruits and vegetables combined with insufficient local supply will drive efforts to increase the volumes grown and improve supply chain efficiencies with the application of new technologies in production and distribution. For example, innovation in agricultural technology ('Ag-Tech') is predicted to be dominated by the horticulture sector in India over the next decade (Mathur, 2017). The potential economic impacts for the Indonesian traditional food sector from moving up the value ladder include socio-economic impacts for local communities (eg. more jobs, more local investment) and new networks of traders and food retailers leading to new market and investment opportunities (Minot, 2013). Rapid urbanization supports the business case for investment in FFV supply chains. For instance, production of perishables such as fresh fruit and vegetables, and associated primary processing operations, tend to grow faster closer to large urban metropolis' and regional cities (Richards et al., 2016). In addition, processing units have incentives to be located closer to wholesale trading sites which allows access to lower grade, out of peak season produce, often better suited for processing (Reardon, Boughton, et al., 2015).

And as with any business model, enterprises can pursue different strategies to generate profit, essentially by either increasing revenues or decreasing costs. Reducing risks in operations (eg. from uncontrollable weather events) and the impact of market volatility is another crucial factor in improving the viability and hence the creditworthiness or investability of agri-businesses.

Revenue growth can be driven by

- Increasing the quantity of existing products sold - to new customer segments (eg. in new geographies or new retail outlets), or increasing the per sale volume sold to existing customers
- Introducing new products, such as new varieties of vegetables, or new products from damaged or deteriorated produce to sell to existing customers. Diversifying the products grown or packaged to diversify revenue sources, or reduce variability in cash flow and stabilise revenue
- New distribution models that bypass middle segments and connect producers to the hospitality or retail end consumers
- Increasing the price of existing products by charging a quality premium or adding value to existing products with new packaging, new sizes or simple processing, eg. pre-mixed vegetable packs for simple soup preparation, preservation treatments to improve shelf life or improved food safety processes
- Stabilising supply can also stabilise revenue flow (reduce volatility)

Profit can also be driven by lowering costs in operations through improvements in efficiency – cost, time, reduce the loss of crop inputs, or lower costs of inputs (breeding, education). Other factors that underpin the credit worthiness or investability of an enterprise include the availability of collateral as security for debt, transparency and availability of historical data on business operators and profit, track record of debt servicing by the enterprise and quality and experience of management.

6.3. Constraints and Risks in financing FFV Supply Chains

To secure private sector funding or blended finance, the potential value capture in a business case must be accompanied by consideration of the risks and barriers to capturing that value.

Constraints on FFV Agri-food enterprises in accessing debt and equity and financial services

Often recognised factors contributing to undeveloped capital markets, to the finance gap for emerging economy SMEs and to agricultural sectors include:

- Credit application preparation capacity
- Collateral to secure debt
- Reasonably priced capital
- Historical and reliable financial records

Interviews with FFV supply chain actors reveal some additional distinguishing features of FFV production, processing and trade that present particular challenges. Constraints on FFV businesses seeking to grow, increase efficiency and build new markets include:

Business models exposed to the vagaries of weak transport and logistics infrastructure, and a lack of market and enterprises history data. Access to high quality, reliable information on production and demand is widely acknowledged as a challenge in food and agri-business across emerging markets (Goedde, Horii, & Sanghvi, 2015). This is a particular challenge in Indonesia with its notoriously poor transport infrastructure between its thousands of islands . Large scale distribution of fruits and vegetables is difficult with inadequate ports, unreliable shipping schedules, poor roads, bad traffic and limited cold chain options impact particularly impact perishable food enterprises (USDA et al., 2016).

Flexible and right-sized financial services. Traders play a crucial role in aggregating, sorting, preserving quality, and transmitting market preferences in FFV supply chains. As such financial offerings must understand and deliver tailored financial services for these business models. Lending to mid-chain mid-sized enterprises, for equipment, fixed assets or working capital requires different internal capacity and a different scale of loans than those provided by impact investors. Many FFV supply chain actors fall into the category of modest SMEs, not the $10m turnover companies classified as SMEs by some DFI programs. Many remain informal, employ a handful of irregular labour, and whilst have graduated beyond microfinance sized credit needs, continue to require loans of a size that are too small to attract the efforts of formal banks. At the same time, these distinctive differences can also present opportunities for new business models in supply of finance, given the size of the market.

Real-time transaction services. Supply chains and retail of highly perishable crops are built around daily purchases. When is the profit generated influences the strength / tightness of the chain. In dairy industry, daily milk production and collection drives very strong relationships between buyers and producers. This profit is generated regularly, and payments must match the delivery schedule.

For FFV, important financial services include payment services. Many FFV crops require daily harvest, short term controlled storage and coordinated supply chains capable of delivering product regularly. As such, fast payment transaction services are highly valued by producers, aggregators and traders as they buy and sell daily consignments. These observed findings are backed up by results from study of potato growers in Indonesia. In the Indonesian FFV context, a study of potato growers in West Java (one of the top five vegetables grown in Indonesia) focused on attributes of buyers and traders that were valued by growers. Different buyers were assessed in terms of which group more effectively induced growers to participate in the relevant market channel: specialised urban wholesalers, contract buyers, traditional market traders, local village traders, large processors or supermarket agents. As stated:

> *"The different types of buyers and supply chains present producers with a range of market channels, each with its own buyer attributes. The demand for specific attributes varies by producer, but certain attributes may reduce risk, lower specific transaction costs, offer market incentives, or loosen household financial constraints. Some buyers, for example, pay cash immediately, at the point of sale, while others offer premium prices for graded and sorted produce. Other buyers provide input credits, certified seeds, technical guidance for adopting new technologies, or information on how to meet the standards preferred by supermarkets and processors. Some buyers are recognised for their integrity, reliability, and consistency."* (Umberger et al., 2015).

This research found that farmers place more importance on buyer attributes related to payment than on those related to the provision of information or inputs such as certified seed. Particularly valued

was the capacity of a trader to make immediate cash payments or pay price premiums for sorting for quality, along with follow through on commitment to buy produce as agreed. The authors suggest that *'farmers' preferences point to their desire to enter into long-term commercial relationships to minimise the risk of non-payment'*. These findings on how supply chain actors are innovating and transitioning in response to growing urban demand for food bolsters the proposition that support for innovation, capacity, access to finance, ease of doing business for small to medium food chain enterprises will benefit and in fact induce greater market participation of smallholder farmers.

Constraints on increasing the supply of capital from impact investors

As discussed in Section 3, it is difficult to source data specifically on finance and investment in SMEs engaged in food value chains, and many of the constraints in lending to FFV businesses are common to the broader SME segment across all industries (trade, agriculture, retail, manufacturing, transport). The SME lending conundrum features high risk lending as there is often little or no appropriate collateral, no contracts to underpin sales projections especially for domestic crops, and expensive lending models as product design, staff training and distribution models require tailoring for different crops, value chains and SME business models (versus mass market microfinance products which benefit from economies of scale with replicated vanilla credit products and scaled lending where small margins can still cover costs) (ISF, 2016) (Wenner & IFPRI, 2010).

Rural banks and local lenders find the economics of lending poor because of

- Demand for credit at viable scale restricting revenue
- Financial information to support credit assessments
- Insufficient volume of digital transactions to generate profit; specialised expertise to deploy these services; and regulatory barriers on mobile wallets (International Finance Corporation, 2010)

FFV supply chains are perceived to be very loose, and hence damaging to investor confidence. In interviews impact investors cited these common challenges:

- Growing practices vary widely within horticulture; inputs, fixed assets (eg. shade, irrigation or crating), planting, growing and harvest times can be very specific to particular crops. FFV present multiple storage, processing and retail systems compared to staple cereal crops or

coffee. Each model requires tailored expertise to assess the different technical processes for this multitude of crops and varieties.

- Business size is often small and sales can be irregular
- Many perishable crops require regular or daily harvest and are harder to aggregate, store and transport than staples cereals.
- Growers of perishables may sell into a diversity of channels to maximise revenue from different quality produce, for example processing for poorer quality tomatoes. This means it is difficult to source reliable sales data or secure sales contracts from single, right-sized buyers. The absence of buyer contracts as a form of collateral will restrict lending or drive up the risk adjusted pricing of debt.
- A focus on domestic markets limits availability of collateral in hard currency and is often associated with poor enforceability of agreements should they actually be secured. There is low demand for finance at a suitable scale from domestic focused farmers and agribusiness'.
- Little market visibility with poor aggregate information on daily volumes and quality of produce - being delivered through many channels - combined with poor predictability of daily demand makes an assessment of production economics and sales potential difficult.
- Timing of cash flows varies greatly depending on the crop, the business model and geographical distribution of producers and buyers
- Investee enterprises display weaker management capability, possibly because enterprises haven't been vetted by international buyers requiring that they meet certain standards, are audited each year by certifiers, etc
- Difficulty of verifying sustainable practices in horticulture, with fewer third party resources available to rely upon, a factor critical to investors focused on environmental impact through sustainable agriculture.

6.4. Dual Value Captured along the FFV Supply Chain

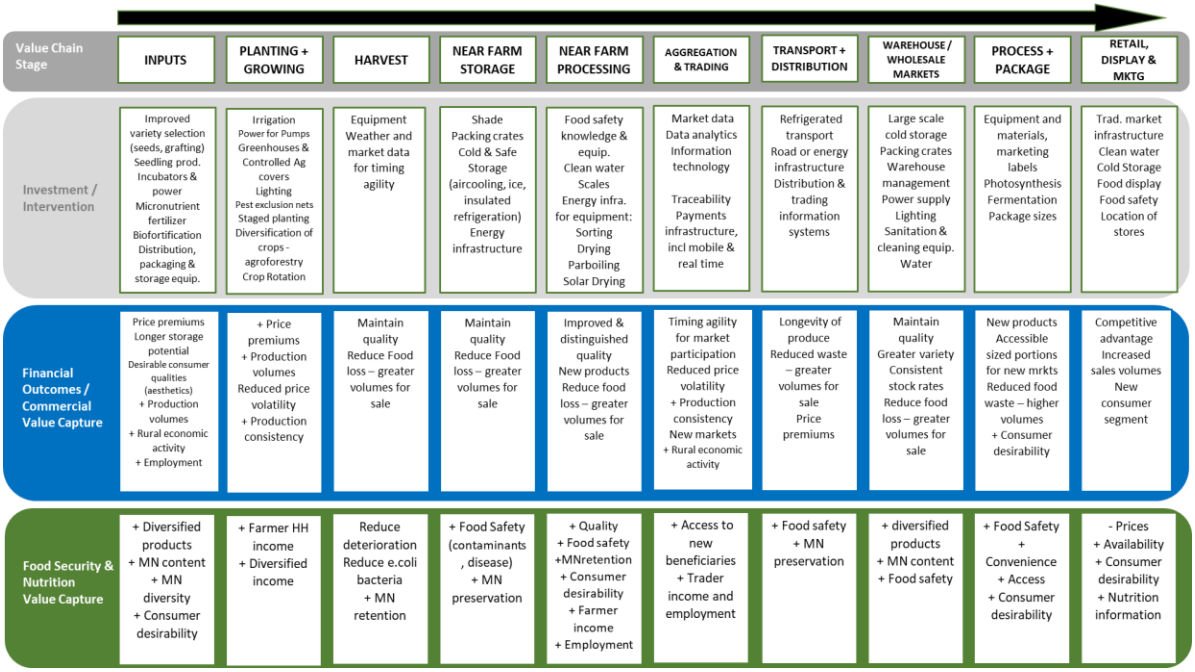
Individual enterprises operating along the chain have new opportunities to capture commercial value by serving new consumers who demand a wider variety in their diets with new products and convenience. Presentation of a clear and viable business case and impact case will help unlock a greater supply of private finance and blended capital into horticultural supply chains. Some claim that over the next decade horticulture will be the dominant driver of ag-tech innovations to preserve

the quality, reduce waste, improve traceability, and improve shelf-life, efficient aggregation, transportation and storage, especially in India (Mathur, 2017).

The following section examines new revenue generation potential for sample enterprises offering products and services along a high-value perishable crop food supply chain, citing examples where successful innovation has been observed in Asian markets (sources for each example business, and further examples, are listed in Appendix e)). New business opportunities are also considered for enterprises offering services like aggregation or market knowledge to strengthen the enabling environment. Some new enterprises are designed to bypass specific mid-chain actors by offering aggregation and delivery services bundled with input finance, or distribution and retail direct to consumer's homes. Of course, an individual business model needs to be tested for viability in a particular market and particular supply chain context. When examining a particular market, strategic questions to examine include 'is there real demand for this exact new product or service, and what is the size of that market'? And what does the product-market combination look like in this food environment and value chain?

The nutrition impact and food security pathway is also presented. Whilst we acknowledge the impact outcome for beneficiaries will probably result from a combination of investments and interventions, for illustration purposes this assists in appreciating the linkages between an investment and the resulting economic and impact value capture. To attract impact oriented funding an FFV agri-SME enterprise, farmer finance program or enabling environment innovation must consider both. Exhibit 26 summarises the financial and impact value capture potential at different stages along the supply chain.

Exhibit 26: Nutrition and Commercial Value Capture from investments along the FFV Supply Chain



Source: Author's own creation

Inputs

Investments / Interventions include in new variety selection capabilities (seeds, cuttings), grafting, seedling production, incubators & power sources, fertilizer, biofortification, timed seed or cutting delivery to support staged planting or distribution and packaging equipment to preserve quality.

Business value comes from new customer markets; price premiums from high value crop seeds new varieties recognised as producing lower perishability, more attractive visible traits, premium branding or more suitable features for growing in a particular climate; and reduced revenue concertation and risk through diversified product offerings.

Nutrition value capture results from diversified products in the food system, increased micronutrient content in produce, increased micronutrient diversity and heightened consumer desirability, demand and consumption.

An example is the development of the 'Stella Melon' variety by East West Seeds in Indonesia (source: project interviews). This 'premium variety' was developed by the specialist tropical horticulture seed producer who recognised that for all supply chain participants to realise economic

value, it needed to bring together the entire supply chain. East West Seeds arranged an exclusive retail contract with a single supermarket chain with a presence all over Java, helped coordinate three select farmer groups to produce and aggregate a guaranteed volume, and brought in a local bank to support fast settlement of payments (3 days) once delivery was made. These aspects of the supply chain arrangement convinced farmers to grow and retailers to stock this new 'exclusive' variety at a higher price, enabling value capture through price premiums for all participants.

Another example is Ricult, operating in Pakistan and Thailand. Prior to aggregation of harvested crops, its platform (accessible from any type of telephone) assesses a farmer's creditworthiness when they register using predictive psychometric tools and credit scoring algorithms. It then provides them with the farm inputs they need dependant on the characteristics of their farmland. Using weather, satellite, soil analytics and other geospatial data streams, Ricult uses machine learning algorithms to map spatial variations in crop and soil conditions to accurately suggest inputs that ensure optimal crop growth. It also provides farmers with the extension services and weather forecasts. Reflecting the growing recognition of the importance of fast settlement, Ricult promises to pay farmers for purchased produce within 48 hours.

Models offering similar services include iProcure in Africa, DeHaat mobile app by Ag Revolution in India and Golden Paddy by Impact Terra in Myanmar.

Planting and growing + harvest: farming as a service

Investments / Interventions can include equipment (fixed assets) and power for irrigation and pumps, greenhouses & controlled agriculture systems, lighting, pest exclusion nets, staged planting, diversification or rotation of crops. Collection and analysis of weather and market data and sold to farmers would support agility in timing plantings and harvest.

Business value can be generated from intensification - increased production volumes, price premiums, reduced price volatility and greater production consistency and sales value resulting from controlled environmental factors that cause deterioration, and greater volumes for sale as food loss is reduced.

Nutrition value capture can result from increased and diversified farmer household income supporting greater expenditure on food in the household budget, reduced produce deterioration/

quality maintenance, improved food safety by controls on contaminants and disease (eg. e.coli or bacteria), and increased micronutrient retention.

Examples include the new models of 'farming as a service' where equipment and farming services are offered to farmers on a pay-per-use basis, transforming equipment costs from a fixed capital expenditure to a variable cost. Examples include Hello Tractor in Nigeria ("Hello Tractor," n.d.) and EM3 Agri Services ("EM3 Agri Services," n.d.) or Gold Farm ("Gold Farm | India's Emerging Agri Platform," n.d.) in India. The model frees up smaller agri-businesses from dedicating capital to purchase their own equipment (which may not even be feasible for many small operators with little or no collateral). These models in India and Nigeria have focused more on grain producers to date, but the model may hold potential for FFV producers for irrigation pumps or land preparation equipment, or who wish to extend control further down the supply chain, eg. by accessing improved storage containers or cold storage at harvest. (In fact these examples actually provide the information technology platform that connect asset owners with farmers, supporting the viability of the asset owner's business as they seek maximum equipment utilisation).

Planting, growing + harvest: Irrigation, protected environment shelters and storage Infrastructure

Investments / Interventions include Shade cloths, Packing crates, Cold & Safe Storage (aircooling, ice, insulated refrigeration) and energy infrastructure. Baskets or dry, open containers with ventilation are good for storing raw fruit and vegetables and can also be hung from roofs in cool environments (Chetail, Bergman, & Mottram, 2015). Root crops like yams and cassava can be stored in underground pits (ibid).

Business value can be captured from price premiums, reduced price volatility and greater production consistency and sales value resulting from controlling environmental factors that cause deterioration, and greater volumes for sale as food loss is reduced.

Nutrition value capture can result from improved food safety by controls on contaminants and disease (eg. e.coli, bacteria or aflatoxins), and micronutrient preservation, especially crucial for perishable fruits and vegetables. Above-ground storage containers can limit the mould, bacteria, pests, and animals that have access to foods.

For example in Nigeria over 40% of fresh tomato production is lost in crating (stacking low quality baskets) and transport (up to 4 days in open roof lorries) alone. The loss presents a business opportunity with estimates that durable crating could reduce losses down to 5-10% (Dalberg Analysis 2016) ("Postharvest Loss Alliance for Nutrition (PLAN) Finance Roundtable Agenda," 2016).

Inspira Farms in SSA provides on or off-grid refrigerated storage solutions, client-centered technical support and affordable leases that enable small and growing agribusinesses to access emerging technology, reduce produce losses, cut energy costs, access new markets and grow sustainably. The company also helps farmers access finance and provides support for how to utilise their new asset effectively.

Near farm processing

Simple processing investments / interventions allow for longer term preservation and storage of raw fruit and vegetables. The most common preservation methods for fruits and vegetables include drying and fermentation (Chetail et al., 2015). Investments include clean water treatment and storage, solar drying infrastructure, scales and energy infrastructure for sorting, drying, or parboiling equipment. Parboiling vegetables involves treatment by steaming and partially cooks vegetables for later use in cooking different meals. It can be done to vegetables like root crops (e.g. potatoes, yams, cassava). Dried fruit and vegetables can be kept in cool, well sealed, dry containers (metal containers are often cooler and drier than plastic) (Chetail et al., 2015).

Business value can be captured from improved & distinguished quality and price premiums, greater volumes for sale as food loss is reduced and new product lines of foods that deteriorate slower.

Nutrition value capture results from enhanced food safety, micronutrient preservation, consumer desirability and demand, and enhanced employment opportunities. Drying (dehydrating) fruit concentrates nutrients to include protein, carbohydrates (sugars), fiber, little to no fat, vitamins A, B1, B6, and B12, calcium, iron, magnesium, phosphorous, potassium, sodium, copper, and manganese. For example, fermenting bananas can increase absorption of iron and other nutrients (Chetail et al., 2015).

Aggregation, Trading and Distribution

Investments / Interventions could include access to knowledge generated from market data analytics, information technology platforms that more closely link producers to the end consumer, traceability, and mobile payments infrastructure, including mobile & real time transaction services. Models providing market linkages and aggregation in horticulture combined with data analytics are predicted to be one of the greatest areas of innovation over the next few years (Mathur, 2017).

Business value can be generated through improving actors agility on timing for market participation, reduced price volatility, production consistency, awareness of and access to new markets and increases in rural economic activity.

Nutrition value capture results from providing access to new consumers with access to healthy products, increased purchasing power for business small business owners and employees.

An example is Panen in Indonesia, a business to business online platform that provides knowledge and information sharing of market demand, both in quantity & quality. The system supports direct trading in produce for farmers who can connect directly with hotels, restaurants & caters.

Similarly, Crofarm in India is a digital market place to guide harvesting timing for farmers, perform quality checks, reduce waste, and provide doorstop delivery to retailers. By physically aggregating and selling produce it tackles the value chain inefficiencies and infrastructural gaps that lead to high rates of post-harvest loss and low profits for producers. The Crofarm marketplace and logistics platform matches and directly connects small-scale producers with small retailers in India, cutting out several value chain links (and sources of produce and value loss) in the process. Crofarm adds logistics to this marketplace function, aggregating supply at produce hubs and developing sophisticated routing functions to ensure speedy delivery. As a result, farmers get better prices, on-time payments, and guidance on market demand while retailers receive higher-quality produce, longer shelf life, and lower loss rates.

Warehouse / wholesale markets

Investments / Intervention: The modernisation of market yards and wholesale market infrastructure is usually the responsibility of the public sector. Whilst new business models mentioned above are disrupting the chain by bypassing wholesale markets, the 'modern wholesaler' will retain an

important and growing role in Indonesia (Reardon, 2015). In order to distinguish themselves to processor and retail customers and establish reliable supplier relationships, these modern wholesalers also require capital to invest in better transport services with modern cross-docking and refrigerated vehicles, packaging materials and ICT systems. Provision of services such as warehousing and cold chain management, the operation of packing houses, managing contract farming, merchandise inventory, and international networks (ibid).

Business value can be generated by maintaining produce quality, providing access to greater variety of items, more closely maintaining consistent stock rates, reduction in food loss allowing greater volumes for sale and adherence to higher food safety standards. Also economies of scale and of scope for larger enterprises can contribute to reduce supply chain costs.

Nutrition value capture results from greater diversity in the micronutrient content of the food system and adherence to higher food safety standards

Processing, preservation and packaging

Investments / Interventions at this point are many and varied are include use of milling, cooling or freezing, smoking, heating, canning, fermentation or extrusion cooking (Augustin et al., 2016) to create new higher value products. Addition of fortificants to increase essential micro-nutrient content has been notably successful in some contexts, eg. in iodised salt.

Business value is generated by accessing new markets, increasing income through higher profit margins of food sold during the off-season or with value-added processing, steadier income flows throughout the year, and stable employment in the processing cycle (Herforth, 2013).

Nutrition value capture can result from increasing and prolonging food availability, access and consumption, preventing loss and waste and extending shelf-life of products, increases in essential nutrient content or improve their palatability and convenience, improvement in food safety by destroying food-borne microbes and toxins (Mathur, 2017). Small sized packaging that targets bottom of the pyramid households which purchase their food daily or convenient combinations of products for time poor women can open up new healthy products to poorer households.

Enabling Environment: Data Analytics

As some of the examples above demonstrate, there are many organisations building business models that leverage data analytics to inform physical decisions. One particularly popular use case is new forms of credit scoring of farmers to support lending decisions.

Business value is created by this new service offering that offers options to increase the customer base and reduce bad debts from poor credit decisions on whom to lend to.

Nutrition value capture is secured through indirect effects for consumer - growing FFV enterprises provide employment opportunities, and access for consumers to healthy products.

An example is FarmDrive in Kenya which uses machine learning, alternative data, and mobile technology to optimise the agriculture supply input in a bid to raise profits for smallholder farmers and vendors. Its system collects and aggregates alternative datasets from multiple sources, to build credit scores, and offers that service to buyers and financial institutions.

Another use of market data is being developed by Hara Indonesia who have built a blockchain data ecosystem. There are four groups of participants in HARA ecosystem: data providers, data buyers, value-added services and data qualifiers. The incentive structure on platform motivates data providers to submit data for which they receive tokens. Farmers benefit from the HARA Token as the HARA app and web portal are gamified such that data providers, such as farmers, who supply data are rewarded with loyalty points. These points may be redeemed for various products and services, such as phone credits, discounts on agriculture supplies, and education supplies.

All these business models and changes in operating practices require financial services. Making the business case for these investments will help attract capital, but to have the greatest impact we need to look at what type of financial service is best suited to the business model, supply chain and commodity being transformed through a particular supply chain.

7. Findings and recommendations

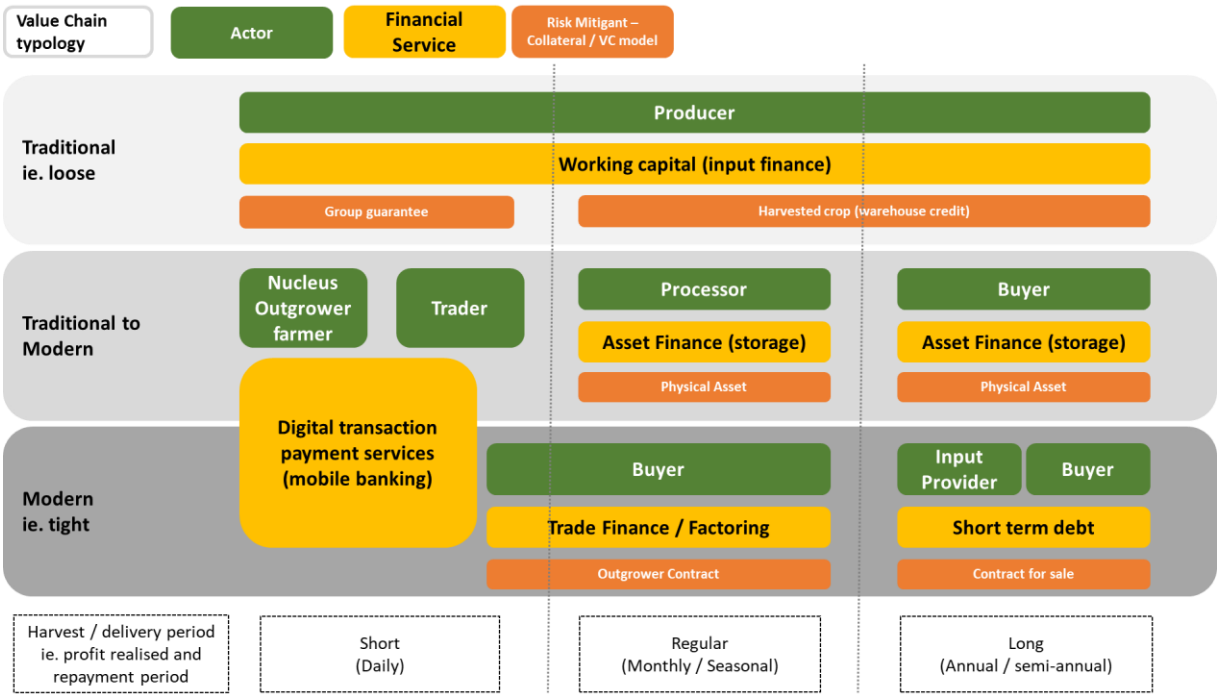
The nutrition and agriculture development communities are increasingly looking at how to promote enhanced nutrition for consumers through value chain strengthening and public-private sector partnerships. Valid outcomes for improved nutrition need to go beyond household and individual health measures to accept systemic change in the composition and diversity of produce supply in the food system. The High Level Panel of Experts on Food Security and Nutrition of the Committee on World Food Security recently recommended improving nutrition through particular attention on post-harvest storage, processing and distribution of fruits and vegetables (HLPE, 2017). The major share of FFV consumed in developing markets is grown domestically. Post farm gate horticultural enterprises – those engaged in mid-chain segments like aggregation, transport, processing, packaging, marketing, distribution and retail - are essential, and possibly the primary, contributors to maintaining and enhancing nutritional value of diets, particularly among poor people. These private sector SMEs can ensure that the best quality and maximum volume of produce reaches the market. Four food security pathways can be delivered through supporting domestic oriented mid-chain FFV SMEs in their economic growth and financial sustainability:

1. increase volume and diversity in the market (which may also be achieved by reducing waste or consistent available supply) – improves availability and physical access
2. increase nutritional quality and safety of existing products,
3. realise more accessible / lower prices (reduce the price dilemma, through efficiencies or increase of supply), and – improves affordability / economic access, and
4. increase or diversify the incomes of producers (who are also consumers)

Different FFV supply chain actors need different financial products and services to enhance their participation (increase incomes), promote efficient chains (reduce the farm gate-retail price spread), promote greater supply (volume and diversity) and preserve quality. Strategies to promote more formal agricultural finance must consider the requirements of a particular commodity supply chain and its different actors (Moyes & Prasetya, 2017). In an attempt to group the multitude of variations this implies, I propose that there are common features of FFV supply chains that can help identify which financial services can be the most impactful for different value chain. Exhibit 27 disaggregates the financial products and services most valuable to differing FFV supply chain typologies based on the growing and harvest periods of the crop. For example, whilst input credit is vital for producers of annual crops such as maize in traditional to modern supply chains, for growers of fast growing

leafy vegetables in traditional to modern supply chains, real time payment services on daily deliveries are more impactful for managing cash flow pressures.

Exhibit 27: Where can financial services provide the best leverage in domestic FFV markets



Source: Author's own creation

As we recognise the differences in FFV markets, and taking into account the research conducted in this study, implications for financial services and investment can be summarized as follows:

- For highly perishable crops with short regular growing seasons (even daily harvest, eg. some fruits like strawberries, tomatoes, zucchini) that require specialised seed inputs, processing, storage, transport and market access reduce the risk and potential of side selling, and may embody more loyalty to buyer as the grower does not want to invest in all those assets without a certain sales channel. In this case the most impactful VCF models are built around a nucleus farm outgrower model with input credit and third party transaction solutions supporting real-time payment
- The growth and transformation of SME market actors engaged in aggregation, storage, distribution, processing and retail requires access to capital to purchase small scale equipment for cold storage, processing, labelling and packaging, and marketing technology. Support for new business models of farming as a service, small scale asset finance for crates, and cool storage,

among others, could drastically alleviate the challenges for SMEs to secure capital to invest in such fixed assets.

- Financing solutions are more attractive if they augment other innovations serving to strengthen an existing supply chain relationship. For example, in the case of the exclusive Stella Melon variety where an exclusive supply arrangement between a grower and a supermarket was augmented with guaranteed payment within 3 days, a new service provided by a local bank and secured as part of the supply deal.
- In the investment supply chain, attention needs to be directed to provision of wholesale capital, agri-food expertise and product design assistance for local financial institutions lending to SMEs. Also required is early stage venture capital to trial and scale new business models connecting producers to urban retailers that serve growing urban populations, and help new startups learn from innovations in other developing country markets. The lack of sales contracts to serve as collateral, and exchange rate risk can be supported with guarantee funds or price supports for currency hedging products.
- Innovation and technology are enabling new methods for sourcing production volumes and demand data to assess creditworthiness using digital data collection, alternative datasets for credit scoring, online marketplaces and blockchain ecosystems. It is imperative that such innovations are utilized to facilitate financing of FFY supply chains in order to achieve improved nutritional outcomes.
- To impact the nutritional content of the food system we must accept the need to prove and enhance the economic viability of a FFV business. Whilst it is important to overtly seek social impact – for example more accessible healthy foods, improved food safety or reduction of food loss - we must crucially design a business model and investment strategy around the business case. This means identifying and accepting market drivers for the sector and the economic incentives that bolster an SME's financial viability. Strategies to attract private sector SME engagement could include access to new distribution channels through subscription and delivery meal plans for urban families, increased profitability and competitive advantage from new packaging that enhances brand visibility, or cost reductions from improved transport and processing efficiencies.
- The nutrition community can help impact investors with selection of the most impactful products/food processing options. Impact investors leverage third party certification programs on sustainable and ethical production to help with investee selection. Existing programs (Fair Trade, Roundtable on Sustainable Palm Oil, Rainforest Alliance) tend to have been designed to

serve international markets and are focused on export commodities. Whatever their criticisms, certifications are shortcuts to monitoring social impact and assist in filtering potential investees. Therefore if there were certification focused on FFV chains this would help investors lend into those businesses. Certification processes can also help build management capability in investees.

C. Appendices

a) Primary Data Collection: List of Interviewees

Organisation	Interviewee	Role
Investors		
RaboBank Rural Fund*	Michaël de Groot	Senior Investment Manager
Root Capital	Brian Milder	EVP Strategy & Innovation
Global Partnerships	Kusi Hornberger	Former VP Investment Research
Alterfin	Hugo Coudere	Senior Advisor, Former MD
OikoCredit*	Frank Rubio	Global Head of Agriculture
ResponsAbility Investments AG	Marie-Anna Bernard	Project Manager for Agricultural Debt Financing
ResponsAbility Investments AG	Coralie David	Senior Research Analyst
Mercy Corps	Sandrine Chetail	Head of Agriculture and Food Security
IFC	Gene Moses	Senior Strategy & Knowledge Officer, Agribusiness Department
IFC	Tomio Alan Komatsu	Investment Officer
IFC	Rick Van Der Kamp	Snr Operations Officer, Agribusiness, Jakarta – East Asia & Pacific
Experts & Practitioners		
Initiative for Smallholder Farmers	Matt Shakovskoy Dan Zook	Directors
GAIN	Bonnie McClafferty	Director, Food Value Chain
ACIAR (Australian Centre for International Agricultural Research)	Rodd Dyer	Research Program Manager, Agribusiness,
Sydney University	Dr. Russell Toth	Senior Lecturer
University of Adelaide	Dale YI	
Cornell University	Miguel Gomez	Associate Professor, Dyson School of Applied Economics and Management
Catholic Relief Services	Shawn Ferris	Director of Agricultural Livelihoods
Opportunity International	John Magnay	Head of Agricultural Fianance
Save the Children UK	Hugh Bagnall-Oakeley	Hunger Policy Advisor
IFPRI	Nick Minot	Deputy Division Director, Markets, Trade, and Institutions Division
Indonesia Agri-Finance and FFV market		
Grower / Aggregator	Pak Andi	Owner, nucleus farm outgrower farmer
Trader	Pak Bagus	Owner, nucleus farm outgrower farmer
Grower, Indonesian Urban FFV Agri-business	Clive Pickering	Owner, Founder
PRISMA - Promoting Rural Income through Support for Markets in Agriculture	Prajwal Shahi	Head of Portfolio (Paladium)
SAFIRA: Strengthening Ag Finance in Rural Areas (Aust-Indo Project)	Lynley Mannell	Team Leader, SAFIRA (Paladium)
SAFIRA	Barclay O'Brien	Ayani Director (formerly Paladium)
IFC	Tomio Alan Komatsu	Investment Officer
Mercy Corps Indonesia	Andi Ikhwan	Indonesia Agriculture and Financial Services Program Director
East West Seeds & EWS Knowledge Transfer	Agung Ignatius Pratama	Sales Director
Indonesian Center for Agro-Social Economic and Policy Studies (ICASEPS)	Bambang Sayaka	Agricultural Economist, Senior Researcher
Indonesian Center for Agro-Social Economic and Policy Studies (ICASEPS)	Dr. Sahat Pasaribu	Agricultural Economist, Senior Researcher
Microsave Consulting*	Ravi Kumar	Agri-finance Consultant

** Responses received via email*

b) Primary Data Collection: Investor Preparation Dec

IMPACT INVESTMENT FOR FOOD SECURITY AND NUTRITION

SCALING UP IMPACT INVESTMENT INTO HIGH NUTRIENT HORTICULTURAL VALUE CHAINS AS A CATALYST FOR DIETARY DIVERSITY

KEY INFORMANT INTERVIEW BRIEFING

INTERVIEW WITH XYZ OF XYZ

DATE: XYZ

REBECCA PARKINSON
GLOBAL PROGRAMS, COLLEGE OF AGRICULTURE AND LIFE SCIENCES, CORNELL UNIVERSITY

CONTEXT OF THE PROJECT

Contribute insights into the opportunity for investment/blended capital in high economic value and high nutrition value crops….

…**with the aim of promoting greater supply of nutritous foods in domestic markets accessed by poor consumers**

- Food security requires stable supply of affordable, diverse foods (availability, accessibility)
- Consumers' nutritional outcomes depend on the quality, quantity & availability of a diverse range of foodstuffs
- Farmers can't operate profitably and sustainably without supporting market systems, enabling environment
- This requires functioning, economically viable supply chains
- Fresh fruit and vegetable 'missing middle' supply chain actors require investment and tailored finance

Current demand for smallholder farmer finance: $200bil / Supply $50bil (Dalberg, ISF, RAF Learning Lab 2016)
Primarily directed to export cash or staple cereal crops.
This does not account for downstrean value chain actor capital needs.

OBJECTIVES OF THIS RESEARCH

Produce a **compelling white paper setting out potential of impact** investment for food security through building the missing middle actors in fresh fruit and vegetable supply chains.

Provide a response to these questions:

1. How can supply of finance support greater diversity and nutrition in agri-food value chains?
2. Is there a role for impact investment to catalyse additional finance?
3. Are there proven business models that overcome barriers to the perception of 'investability' of downstream actors in fruit and vegetable value chains?
4. How can we incentivise more investment to improve nutrition in the agri-food system at scale?

DISCUSSION POINTS - INVESTORS

Investment Mandate	Funding provided
	Return generation, time horizon, sectors, capital preservation v's cash flow
Impacts sought & measured	What social and environmental impacts are targeted?
	How (and if) does nutrition factor in?
Food Systems	Is crop diversity prioritised in your portfolio?
	How do you think about high and low priority value chains?
	Domestic market potential

APPROACH

1. Introduction:
   - Literature Review & Situation Analysis:
   - The supply **landscape** of impact investment into food and Ag value chains
2. Examination of Constraints: reasons for overlooking **nutritous** crops in ag. finance and VC strengthening portfolios
   - Key informant interviews x 8 -10 with impact investors / industry actors ← YOU
3. Case Studies: Indonesian market
   - Supply of finance products to tomato and melon supply chains
   - Demand from farmers and mid-chain actors for financial products

Key Inputs
- Secondary research of academic literature
- Examination of Impact Inv dealflow databases
- Key informant interviews with investors, practitioners, financiers and operators

Timeline

Draft situation review	Q1 2017
Interviews	Q2 2017
Final report	Sept 2017

c) Primary Data Collection: Interview Questionnaire

Impact Investor/ Portfolio Mgr Interview questions:
Identifying barriers to expanding Ag investment to fresh fruit and vegetables

☐ *Permission to record the conversations*
☐ *Ask for Impact Measurement framework and KPIs*

Organisation _____ **Date** _____

Name _____ **Role** _____

Assumption: not much impact investment $$ directed into enhancing nutrition value of foods along the chain. Mostly reductionist micronutrient enhancements or calorie focused investments. – I will prove this with the numbers. Look at retail and wholesale funding.

Contents

Follow Ups – discussed on call	Follow Ups – to ask for
•	

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1. Mandates – Investment stage

Question: At what stage of the investment supply chain do you operate? Ie. how are you generating return (coupon v's capital growth).
What is your time horizon for generating return to the fund/on an investment?

Testing: NA, this is a broad question to be answered as suits the investor

Equity into structured investment funds	Debt into structured investment funds	Direct private equity into companies (incl. producer orgs)	Direct debt into companies / agribusiness (eg. services or equip; incl. producer orgs) (ref Q8 for which ones)	Equity or debt to local lenders	Debt LP for specific rural credit products	To farmer producers directly

Commentary
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2. Mandates – return profile and trade-off of financial vs. social impact

Question: How would you describe your mandate - what are you looking for when you approach the ideas of food security or agricultural value chain investment?

Testing: NA, this is a broad question to be answered as suits the investor

Negative screen	Positive impact					

Commentary
……

3. Impact externalities - which are prioritised?

Question: What are the **primary** non-financial impacts you are seeking from this agric. focused portfolio? [different to measuring, in Q5….]

Testing: Nutrition outcomes or nutrition pathways are not overtly considered / specifically sought or measured by most impact investors

Poverty - Income	Food security	Agricultural productivity	Livelihoods (Smallholder farmer market integration)	Nutrition outcomes	Education	Financial Inclusion	Environment	Health	Other

Commentary
……

4. Impact externalities - why not include/prioritise nutrition as an outcome sought?

Question: If nutrition outcomes are not a formal component of your impact decision on an investment, why is that?

Testing: Demand from staple crop producers is so high that the volume of demand crowds out projects that target different crops.
You can support livelihoods, promote smallholder agricultural integration & poverty alleviation without departing from those less risky (commodity) markets

Don't think human nutrition is important for them to focus on	Available funding doesn't seek nutrition outcomes	Development outcomes sought are biased towards a single outcome (eg. livelihoods, smallholder agricultural production, etc as above)	Outcome attribution is too difficult Eg. human nutrition is too far removed from farmer production	Outcomes delivered by focusing on staple cereals are good enough Eg. don't need to expand portfolio into riskier VCs to deliver positive outcomes	Fuzzy measurement &/or attribution of nutrition outcomes are too hard to link to the specific VC activities

Commentary

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5. Food system - Impact measurement levels

Question: If you are seeking to strengthen food systems / enhance food security, **at what level is impact measured** from the portfolio / investment mandate?

Testing: Systemic change in the food system is too complex to grapple with (the role of agriculture in improving nutrition is tricky to prove)

Nutrition outcomes are the domain of human health programs focused on the individual human

NOT FOCUSED ON FOOD SYSTEM	International economy	Domestic economy	Market level	Business/ entity level	Project	Community	Individual & HHs

Commentary

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6. Food system – crop diversity

Question: Do you overtly and initially seek crop diversity when building your portfolio of VC investments?

Why / Why not?

Testing: Crop diversity is a secondary consideration to market features (risk and return potential) and the enabling environment in the investment decision

The crop is a window to the VC and market features, not of value in and of itself	Nutrition features are not considered	Diversity of production at the HH level is not a priority	Diversity of production is increasingly recognised as a risk mit tool for the farmers, so also good for the investor	Volume of farmers participating – aggregation opportunities is v. important which is in conflict with seeking diversity	Geographic diversity is better than crop or supply chain diversity	

Commentary

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7. Food system focus - High and low priority value chains (commodities v's high value crop selection)

Question: Do you overtly and initially look at the crop when selecting an investment? Which crop value chains do you focus on and why?

Testing: Crop contribution to nutrition is a secondary consideration to risk. Risk also dominates over return potential; Commodity crops are lower risk: visibility into market information (price, volume, quality) is better for those commodities with international trading platforms (stock exchanges), hedging instruments (eg. futures contracts).

Tighter VCs - fewer downstream actors who are more sophisticated	Have guaranteed **offtaker**	Seeking **volume** products over quality/high value. Aggregation opportunities b/c of volume of farmers participating.	Addressing food safety risks in FFV adds too much cost	Focus on export market commodity crops over FFV because of higher market visibility, information, predictability and risk mitigation tools (futures)	Quantifying the value of crop produce and risk is harder as no international trading platform	Capex required to capture value along the chain = too high

Commentary

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8. Food system focus - value chain component

Question: Which components of the food value chain do the bulk of your agri-business investments focus on?

Testing: Impact investment for food security remains focused on value capture for farmers at the production and early stage processing end (rather than retaining quality or reducing loss by mid-chain agribusinesses)

Seeds	Inputs (fertilizer, pesticides)	Production practices & equipment	Processing	Storage	Transport / distribution	Packaging & marketing	Retail

Commentary

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9. Food system focus - domestic markets

Question: How do you think about the potential of domestic markets when considering crop or VC or investment selection?

Testing: Wariness with domestic market orientated crops because of ongoing staple grain fundamentalism in agricultural production policy and stimuli (production and supply supports dominate demand potential)

Biased staple grains export food system enabling environment (ag policy, ag research, national ag investment, food safety legislation, supply chain infrastructure, govt. producer supports & trade policies)	Diversity of production, markets and small scale output adds too much risk		Tech (and power) for quality maintenance is too expensive	Disaggregated demand as much output is traded informally hence very hard to assess and measure business potential	Low demand for finance at matched scale from domestic focused farmers / agribusiness

Commentary

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10. Investment scope - financial objectives

Question: What are the most important financial features/outcomes of an investment when adding to your portfolio?

Testing: Scale of investment and volume/aggregation of underlying asset, market maturity and market visibility/knowledge transfer are more important than innovation and impact.

Liquidity of investment	Internal familiarity with the business model (issue = a lack of capacity to effectively do DD or credit assessments on many different business models to capture value)	Market transparency / visibility (published prices)	Match with investment horizon, time to profitability	Capital preservation, (or cash flow match for debt)	Fit into the risk profile of the portfolio	Partner's diversity of revenue sources / Business model of the entity	Scale to minimise transaction costs	Confidence in management	General market maturity

Commentary

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11. Optional questions

Question: What are the features of a project/investment agribusiness model that make it more attractive to you?

Testing: Understanding the business model (issue = a lack of capacity to effectively do credit assessments on lots of different business models to capture value)

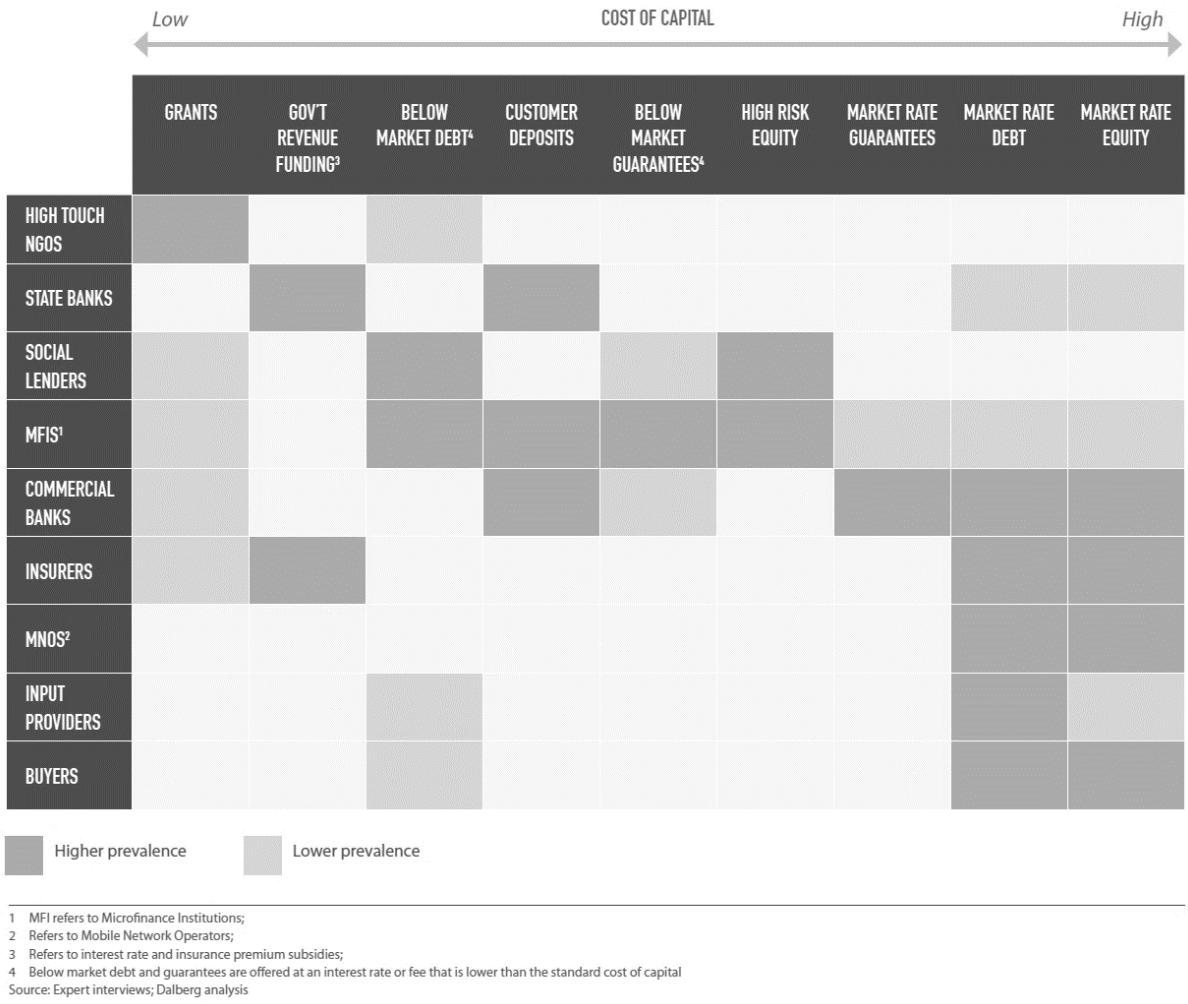
Question: How prevalent are formal risk mitigation instruments like futures, guarantees in your portfolio mgmt. or amongst your investees?

Testing: The absence of futures markets is a barrier for increasing investment in FFV VCs (ie. uncontrolled price and production risk because intermediary risk mgmt. markets are undeveloped)

Question: What would incentivise you to direct more of your portfolio towards FFV?

Testing: ….

d) ISF: Types of Capital Accessed by Financial Services Providers



1 MFI refers to Microfinance Institutions;
2 Refers to Mobile Network Operators;
3 Refers to interest rate and insurance premium subsidies;
4 Below market debt and guarantees are offered at an interest rate or fee that is lower than the standard cost of capital
Source: Expert interviews; Dalberg analysis

Source: (ISF, 2016)

e) FFV Supply Chain enterprise business models

Supply Chain segment	Enterprise Name	Description	Further information
Inputs	Stella Melon East-West Seeds	Indonesia East West Seeds arranged an exclusive retail contract with a single supermarket chain with a presence all over Java, helped coordinate three select farmer groups to produce and aggregate a guaranteed volume, and brought in a local bank to support fast settlement of payments (3 days) once delivery was made. These aspects of the supply chain arrangement convinced farmers to grow and retailers to stock this new 'exclusive' variety at a higher price, enabling value capture through price premiums for all participants. An exclusive supply arrangement between a grower and a supermarket was augmented with guaranteed payment within 3 days, a new service provided by a local bank and secured as part of the supply deal.	
	iProcure	Rural Africa iProcure is the largest agricultural supply chain platform in rural Africa. Uses machine learning, alternative data, and mobile technology to optimize the agriculture supply input in a bid to raise profits for farmers and vendors. In addition to complete procurement and last mile distribution services, we provide business intelligence and data-driven stock management across the supply chains. We deliver great value to both suppliers and farmers. (also in Zotero)	https://iprocu.re/
	Ricult	Pakistan and Thailand Fintech data Ricult, which just raised $1.85 million in seed funding and is backed by the Bill & Melinda Gates Foundation, aims to do just that with has a digital platform emulating the services middlemen provide but transparently and at reasonable rates. The platform, that's accessible from any type of telephone, assesses a farmer's creditworthiness when they register using predictive psychometric tools and credit scoring algorithms. It then provides them with the farm inputs they need dependant on the characteristics of their farmland. Using weather, satellite, soil analytics and other geospatial data streams, Ricult uses machine learning algorithms to map spatial variations in crop and soil conditions to accurately suggest inputs that ensure optimal crop growth. Ricult also provides farmers with the information they need to help them grow more successfully — such as pest attack and weather forecasts. Ricult promises to pay farmers within 48 hours, which is a huge departure from their current situation.	http://www.ricult.com/
	Golden Paddy Impact Terra	Myanmar Provides digital services and finance to farmers and organizations	https://www.impactterra.com/how-we-help-farmers/ https://agfundernews.com/impact-terra-social-enterprise-myanmar-seed.html

Supply Chain segment	Enterprise Name	Description	Further information
	DeHaat mobile app by Ag Revolution	India Mobile based technology to connect small farmers in India to the best source of Agri inputs (Seed, Fertilizer, Crop Protection), Crop advisory, Farm equipment & Market linkage of the farm produce. Also provides crop advisory through mobile module of farmers' services for crop planning, crop reminder calls in local language, crop monitoring and other relevant information related to weather & market. And aggregates production output at collection centres.	http://www.agrevolution.in/offerings
Planting, growing + harvest: Farming as a service	Hello Tractor	Nigeria Farming as a service' where equipment and farming services are offered to farmers on a pay-per-use basis, transforming equipment costs from a fixed capital expenditure to a variable cost	("Hello Tractor," n.d.)
	EM3 Agri Services	India Farming as a service' where equipment and farming services are offered to farmers on a pay-per-use basis, transforming equipment costs from a fixed capital expenditure to a variable cost	("EM3 Agri Services," n.d.)
	Gold Farm	India Farming as a service' where equipment and farming services are offered to farmers on a pay-per-use basis, transforming equipment costs from a fixed capital expenditure to a variable cost.	("Gold Farm | India's Emerging Agri Platform," n.d.)
Planting, growing + harvest: Irrigation, protected environment shelters and storage Infrastructure	InspiraFarms	East Africa Produces cold storage and agriprocessing facilities for agricultural value chains in developing world markets. Its food safety-certified units help shift small commercial farmers from low-value, loosely integrated value chains (categorized by high rates of spoilage) to high-value, tightly integrated value chains (with systems that minimize losses and costs). Where electricity is unreliable or where there is no electricity at all, InspiraFarms units use thermal storage technology to provide continuous cooling to horticultural crops and dairy. Information systems built into its facilities capture data about the agricultural products. This allows customers to manage their operations and value chains more efficiently, and improves traceability for those products across the value chain. But InspiraFarms must do more than offer high-value facilities. While some "not too much" investors in the sector have warned against becoming a finance company, InspiraFarms has deliberately and efficiently put its technology within financial reach of the businesses it serves with a credit facility that allows customers to pay for units as they realize their value. https://ssir.org/articles/entry/in_defense_of_doing_too_much#	http://www.inspirafarms.com/
	Futurepump	Kenya Develops solar-powered irrigation technologies to help the 500 million one-acre farmers around the world. Based in Kenya, it offers smallholder farmers a cheaper, cleaner and more sustainable alternative to costly and polluting petrol or diesel pumps. Irrigating crops	https://futurepump.com/

Supply Chain segment	Enterprise Name	Description	Further information
		on demand leads to more reliable harvests. It also gives farmers the opportunity to grow and sell crops out of season, bringing huge economic benefits to the farmers, their families, and the wider community.	
	SunCulture	Kenya Sells drip irrigation kits that use solar energy to pump water from any source	http://sunculture.com/
	Aqysta	Nepal Pumps: hydro-powered pumps which do not require any fuel or electricity to be operated.	https://aqysta.com/
	Illuminum Greenhouses	Kenya An agri-tech greenhouse and drip installation company working with smallholder farmers to improve production and increase efficiency through the use of new modern technologies. They construct affordable modern greenhouses and install automated drip irrigation kits for smallholder farmers by using locally available materials and solar-powered sensors.	https://illuminumgreenhouses.com/
	Thermogenn	SSA Has developed high-performance, off-grid, portable, evaporative coolers to expand smallholder farmers' marketable dairy products in sub-Saharan Africa, mitigating spoilage to allow farmers to sell their dairy products later in the day instead of only in the morning.	http://www.smallholderfortunes.uga.edu/
	Wakati	Africa Developed the world's first standalone solution for the preservation of fruits and vegetables without using cooling. Smallholder farmers can store their produce on their farms in a protective microclimate inside a tent with a storage of 200 -1000 kg, using one liter of water per week, and powered by a small solar panel.	http://www.wakati.org/
Aggregation and distribution	IGrow Indonesia	Indonesia Crowd sourcing organic crops and linking to markets iGrow is a marketplace that helps underemployed farmers, under-utilized land, and investors to produce high-quality organic food and sustainable incomes with cloud-based agricultural management software. We raise capital for seeds from urban people and we give a Farmville-like experience to investors so they not only can see their investments, but have the fun of knowing they're growing beautiful, nutritious food. IGrow can connect farmers, landowners, investors, and crop buyers to create a complete farming supply chain. We identify crops with stable demand, prices and growing characteristics.	https://igrow.asia/v1/about
	Panen	Indonesia B2B platform supporting direct trading in produce for farmers, connecting them to end customers, which we address is Hotel, Restaurant & Catering. Knowledge & information sharing of the markets demands, both in quantity & quality.	http://panen.id/index.html
	Crofarm	India A digital market place to guide harvesting timing for farmers, perform quality checks, reduce waste, and provide doorstop delivery to retailers. It tackles the value chain	http://crofarm.com/

Supply Chain segment	Enterprise Name	Description	Further information
		inefficiencies and infrastructural gaps that lead to high rates of post-harvest loss and low profits for producers. Unlike the if-you-build-it-digitally-they-will-come caricature described earlier, Crofarm is building a marketplace and logistics platform that efficiently matches and directly connects small-scale producers with small retailers in India, cutting out several value chain links (and sources of produce and value loss) in the process. Crofarm does not just provide a digital marketplace. It has built applications (including some that work without a smartphone) that get all relevant players onto the platform with limited friction. Importantly, Crofarm adds logistics to this marketplace function, aggregating supply at produce hubs and developing sophisticated routing functions to ensure speedy delivery. As a result, farmers get better prices, on-time payments, and guidance on market demand while retailers receive higher-quality produce, longer shelf life, and lower loss rates. If it didn't physically aggregate and move produce, Crofarm's solution would not be sufficient. By "doing too much" Crofarm creates the gravitational pull to get retailers and farmers onto its platform and the stickiness to keep them there.	
	FarmFolks Agro	Bangalore, India Sources fresh produce directly from the farmers with no intermediaries. The endeavour is to ensure the traceability of the farmer, his practices on the crops so that various interventions are possible on making the final produce of better quality & safe for the consumers.	http://www.farmfolksagro.com/
	Loopapp By Digital Green	India	http://www.digitalgreen.org/loop/
	Sabziwala	India B2B horticulture distributor	http://www.sabziwala.com/
	Green AgTech	India Focused on reducing multiple intermediaries in the supply chain of Fruits & Vegetables by directly procuring from small farmers and selling to hotels, restaurants and retailers. Built an in-house built proprietary technology platform to enable demand aggregation. The predictable large scale demand aggregation is the most critical aspect of facilitating meaningful size procurements directly from the farmers. Green AgTech is committed to significantly enhancing income levels of farmers and the quality of vegetables supplied to B2B customers by establishing a completely process driven supply chain.	https://www.elevarequity.com/entrepreneur/green-agtech/
	Twiga Foods	Nairobi, Kenya B2B horticulture distributor) does inputs and finance with credit scoring IBM has been working with the Kenya-based food logistics startup Twiga Foods to facilitate micro-lending options for food vendors. Twiga Foods operates a mobile-based business-to-business supply platform for retail outlets and stalls. After analyzing these purchase records from mobile devices, IBM researchers determine creditworthiness, after which they use blockchain technology to administer the entire lending experience from application to receiving offers to accepting terms of repayment. The first eight-week pilot	http://twigafoods.com/

Supply Chain segment	Enterprise Name	Description	Further information
		processed more than 220 loans averaging $30 each, with customers repaying within four to eight days with an interest rate of up to 2%.	
	Get It Rwanda	Rwanda Direct trade to businesses from farmers	http://getitrwanda.com/
	Merakisan	India	https://www.shopping.merakisan.com/
	Ninjacart	India	http://ninjacart.in/
	Krishihub	India	http://krishihub.com/index.html
	Agruppa	Colombia Farmer to corner store distribution	
Cold Chain transport	Citifresh	India United Technologies Corporation's Carrier unit, a leading provider of refrigeration solutions, is now marketing a stripped down refrigerated truck in India. Called Citifresh, it retails for about one-tenth of the cost of more sophisticated versions used in the US and Europe.	https://businesswireindia.com/news/news-details/carrier-transicolds-new-citifresh-unit-providesfresh-only-refrigerated-transport-solution-india/40437
Warehouse / wholesale markets			
Process and package			
Retail	YCook	India Fresh veg packaging "Y-Cook, a food Technology Company, creating a new category in the food space – the category of minimally processed vegetables, lentils and fruits. Our unique and differentiated processing allows field fresh produce to retain their natural freshness, colour, texture, flavour and nutrients for 12 months without any preservatives or additives or even refrigeration. By bringing together health, taste, and convenience, we make it easier than ever for people to enjoy home gourmet. Being good to yourself has never been so easy!"	http://www.ycook.in/
	Original Indian Table	India Brings traditional food ingredients straight from the farm to the kitchen Sources and delivers products grown by farmers who are reviving traditional crops and sustainable farming.	http://originalindiantable.com/ http://cropconnect.in/
	Sayurbox Indonesia	Indonesia Farm to table fresh produce distribution platform	https://www.sayurbox.com/
Enabling Environment			

Supply Chain segment	Enterprise Name	Description	Further information
Credit Scoring	*FarmDrive*	Kenya Uses machine learning, alternative data, and mobile technology to optimize the agriculture supply input in a bid to raise profits for farmers and vendors. Collects and aggregates alternative datasets from multiple sources, in Kenya and around the world, to build credit scores for smallholder farmers in Africa. FarmDrive uses mobile phones, alternative data, and machine learning to close the critical data gap that prevents financial institutions from lending to creditworthy smallholder farmers. Offers services to farmers and to financial institutions – whose balance sheet is the LP on??	https://farmdrive.co.ke/
	MyAgro	Senegal and Mali A mobile savings system enabling farmers to pay for crucial inputs like seed and fertilizer in pre-paid instalments.	
Market Data and ecosystem building	Hara Indonesia	Indonesia A blockchain data ecosystem. There are four groups of participants in HARA ecosystem: data providers, data buyers, value-added services and data qualifiers. Farmers benefit from the HARA Token as the HARA app and web portal are gamified such that data providers, such as farmers, who supply data are rewarded with loyalty points. These points may be redeemed for various products and services, such as phone credits, discounts on agriculture supplies, and education supplies. How will contributors of HARA Token benefit? There is a clear market need for data and the incentive structure on platform motivates data providers to submit data and enables scalability. HARA already has a proven track record in Indonesia and is planning to expand to other equatorial countries.	https://haratoken.io/#solution
	m-Farm	Kenya A virtual co-operative where farmers in the same areas can share their experiences, pose questions to industry experts, and connect with each other, combine produce and find buyers.	https://www.mfarm.co.ke/

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